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[See Advertisement on page ix.]

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United States Patent No. 80,378 August 11, 1868,
" " 131,786 October 1, 1872,
" " 132,416 " 22, 1872
" " 169,811 Nov. 9, 1875, and

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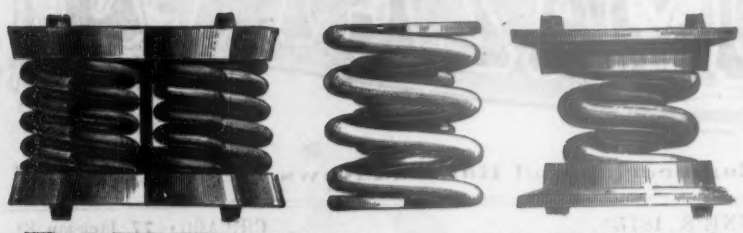

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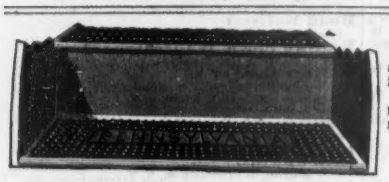

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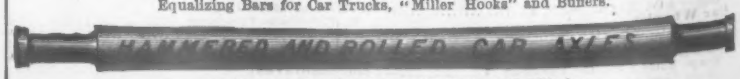

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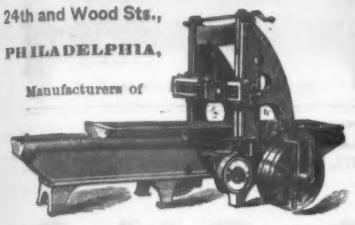

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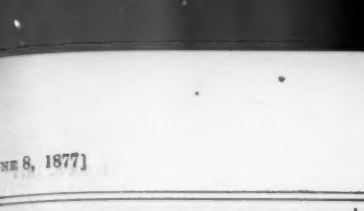

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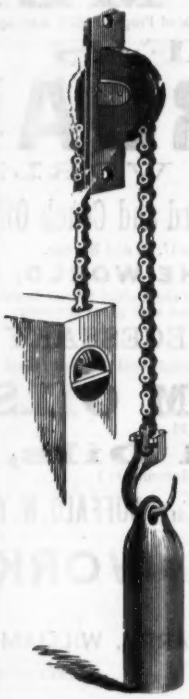

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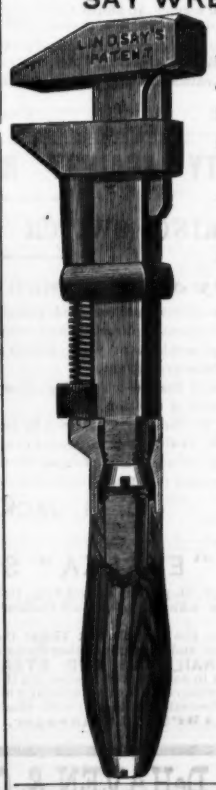

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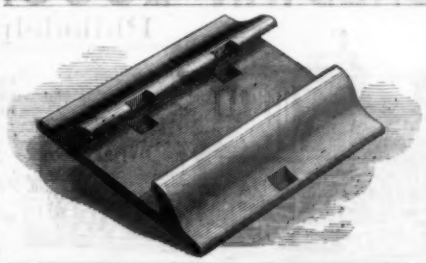

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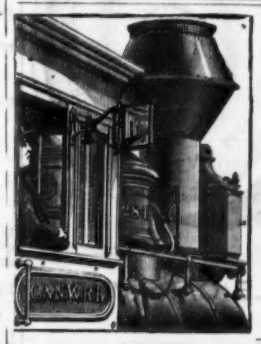

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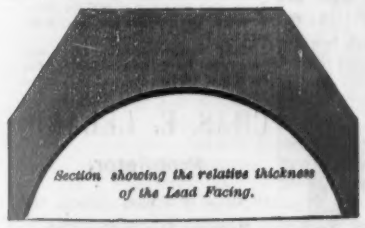

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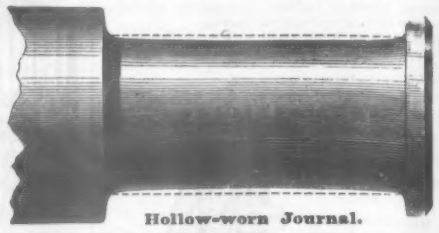

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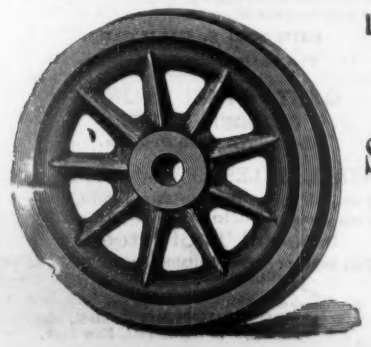

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RAILROAD GAZETTE

FRIDAY, JUNE 8, 1877.

Contributions.

Signal Equipment of the Pennsylvania Railroad—Centennial System of Tracks.

BY R. H. SOULE.

(*Concluded from page 242.*)

It remains to speak more in detail of the apparatus in use at Belmont tower. The pneumatic system, as then established, embodied the use of apparatus for effecting the quick movement of switches and signals, by the expansive force of compressed air, and for *repeating* those movements (by indicators) at the point where the system was operated and controlled. The system comprised special apparatus as follows:

I. Apparatus for compressing and storing air.

II. Apparatus for controlling the distribution of the air, for exhibiting certain indication its work has been done; and for *interlocking* the operating levers or handles.

III. Apparatus for effecting (at the will of the operator) the unlocking movement, and locking again, of switch-rails, and for allowing a *return current* which should move the indicator.

IV. Apparatus for moving signals promptly, and allowing a return current, as before.

V. Connections.

The apparatus will be briefly described under the above heads.

Apparatus for Compressing and Storing Air.—At Mantua crossing use was made of a Westinghouse air-pump, which took steam from a small vertical tubular boiler. By this pump air was forced into a cylindrical reservoir (30 in. diameter by 20 ft. long), and there stored at as high pressure as could be attained. With the boiler and pump used at Mantua, 60 pounds air pressure in the first storage reservoir was found to be an average maximum.

A second reservoir (24 in. diameter by 12 ft. long) was provided, and received its air supply from reservoir No. 1, by a proper pipe connection. In this connecting-pipe was placed a reducing valve, which acted *automatically*, cutting off the supply of air from No. 2 reservoir when 20 pounds pressure had been attained in it, and instantly feeding in air when the pressure fell below that point again.

It was from this second reservoir, containing air at 20 pounds, that the switch and signal cylinders received their supply as controlled by the operator in the tower.

II. *Apparatus for Distributing, Interlocking, etc.*—The distribution of the air was controlled entirely by the operator in the signal tower. The operating cocks were all in the same horizontal plane, their stems projecting forward through the front of the case which enclosed this portion of the apparatus, and terminating in short lever handles. The pressure main from No. 2 reservoir was led horizontally under the operating case, and from it extended short branch pipes communicating directly with the several air cocks, the further progress of the air being then determined by the position of the ports in the plugs.

Directly above each cock handle was its appropriate indicator. These indicators were colored slides attached to the piston rods of small indicating cylinders, and working close to the face of the case, their changes of position and color being visible through openings, which were made round for signals and square for switches.

The signal indicators changed color from red to white, or green to white, to correspond to the signal which they represented, and the switch indicators from blue to black, when the switches were moved from their nominal to their altered positions.

The interlocking devices were very simple. Each cock stem was provided with a small cam which worked between two fingers depending from a horizontal bar directly above, and the horizontal bar therefore had a longitudinal motion whenever the position of the cock plug was altered. A proper disposition of hooked fingers on these traveling bars, and notched cams on the various cock stems, provided such mutual interlocking action as was essential to the situation.

III. *Apparatus for Unlocking, Moving, and Locking Switches, etc.*—Figs. 6, 7 and 8 are sectional views of the switch cylinder and its appendages. This cylinder is spiked firmly to the ties opposite the head of the switch rails, between which and the "switch bar" (so marked in Figs. 6 and 7) a suitable jointed connection is introduced. This "switch bar" is widened out at the end nearest the cylinder (Fig. 7) and provided with two circular holes, into one or the other of which, at the termination of the stroke, the vertical lock-bolt drops, it being surmounted by a heavy weight (25 lbs., Figs. 6 and 8).

To effect a raising of the lock, preparatory to a movement of the rails, a special device is made use of. A rectangular "yoke" (Fig. 7) is attached to the piston rod, and embraces the widened end of the "switch bar," allowing about 2½ in. lost motion between the two. The *sides* of this yoke are raised, and terminate either way in inclined planes, which, when the piston and yoke move, have the effect of *lifting* the lock, through the medium of the transverse pin and rollers which are attached to it (Figs. 6 and 8).

When the lock is entirely disengaged from the switch bar the yoke has traveled through all its lost motion, and the switch bar and rails begin to move. When fairly over in their new position, the lock drops into the other hole, and the rails are secure.

To rightly understand the course of the air currents during one complete cycle of movements would necessitate reference to diagrams which want of space precludes us from inserting. We will, however, briefly outline the progress of the current from the time the operator turns on the supply. The air rushes through the line of piping to the switch and forces the piston (Fig. 6) towards the left. The yoke advancing first raises the lock, and thereby *closes* the exhaust valve; then forces the switch rails over; whereupon, if everything is right, the lock drops into the hole and *opens* the exhaust valve. The supply of air has not yet been cut off, and the current returns, through a second line of pipe (which is lead off from the exhaust valve below the valve seat), to the tower. Here it accumulates pressure behind the piston of a small indicating cylinder (already alluded to) and forces it over, thereby moving the attached indicator slide, and, by means of a cock worked from the piston rod, automatically cutting off the supply of air which has been continuously feeding in from the pressure main. Exhaust vents are, by the same action, opened, and the air confined in pipes and cylinders is allowed to escape. The hand cock, worked by the operator, is six-way and three-ported, while the indicator-cock is six-way and two-ported.

The whole arrangement of cocks and pipes is a very pretty mechanical conception, and possesses the merit of being compact and readily accessible.

To review the action of the air pressure, it will be observed that from the simple turning of a cock handle, the following results ensue:

The switch is unlocked, moved, and locked again; the indicator in the tower has been moved (provided the switch movement and locking were perfect); the air supply has been cut off; the confined air allowed to exhaust; and the whole system of ports, pipes, and passages left in readiness for effecting the reverse motion, at the will of the operator.

Thus it is to be seen that the operations are for the most part automatic.

IV. *Apparatus for Moving Signals, etc.*—a line of piping is led from the hand cock (three-way) in the tower to the cylinder directly under the signals. A second line returns from near the top of the cylinder to the indicator cylinder in the tower. Both cylinders stand vertically, and both signal and indicator banners are loaded so as to drop down to red when relieved from air pressure below. When the operator admits air to the signal cylinder, the piston and signal are raised. Near the end of its up stroke, the piston rod automatically opens a three-way cock so that the air is admitted to the return pipe; and immediately the indicator changes to correspond to the signal.

By reversing the hand cock, the air is exhausted from the signal cylinder, and the signal falls to red. Near the bottom of its stroke, the piston rod automatically reverses the three-way cock, allowing the air, which was confined in the indicator pipe, to exhaust at the signal post, whereupon the indicator itself immediately falls to red.

V. *Connections.*—With the exception of the piping in the engine house, and the air main to the tower, the connections were all ⅛ in. gas-pipes. There must be two lines of pipes to each switch, and to each signal having an indicator.

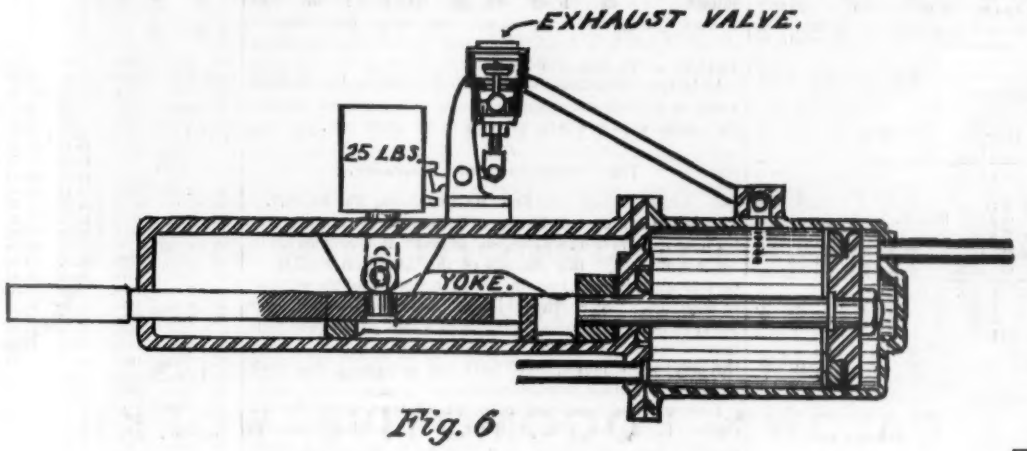


Fig. 6

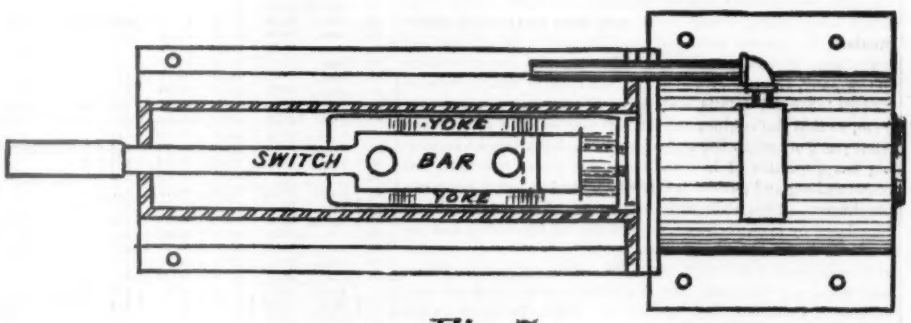


Fig. 7

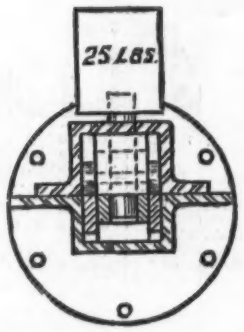


Fig. 8

Some of the advantages in the use of the pneumatic system are:

First. Economy of space occupied by the apparatus (relatively to any of the manual systems).

Second. Economy of cost of putting in the apparatus.

Third. Economy of time of operation of switches and signals.

Fourth. Concentration of moving parts.

The Thirty-sixth street tower may be taken for illustrating the first point. This tower was made 14 ft. 10 in. × 18 ft. 9 in. to take the apparatus of 16 levers (manual system) which governs the junction at that point. The floor space in the second story is very largely monopolized by the levers, while the room below is divided and cluttered up by the connections which depend from above. A pneumatic apparatus of the same number of levers (16) could have been readily contained in an ordinary standard telegraph tower (12 × 12 ft. octagonal), with nearly as much floor space remaining available in the second story as there now is at Thirty-sixth street, while the lower story would have been wholly free from any encroachment by the apparatus. The relative cost of the two towers is approximately 2 to 1.

The space occupied by the air-compressing apparatus is not here taken into account, it being assumed that it is separately provided for; one set of compressors being adequate to the supply of several adjacent towers.

As to *economy in cost of putting in the apparatus*, it is quite certain that the two lines of piping to each switch and signal, in the pneumatic system, are less costly, when laid ready for service, than the single line in the manual system.

In the latter case it is incumbent to excavate a continuous and carefully-aligned trench of an average cross-section of 200 sq. in.; to make, lay in place, level and align boxing of 55 in. timber section; to provide, place and fasten down sheave-

stands every 7 or 8 feet; to provide and sink *oak foundations* every 500 ft. or thereabouts for equalizers, and at every angle for bell cranks; to lay the piping and space the joints so as to clear the sheave-stands.

To reach the same signal or switch by the pneumatic connections, our trench would be about 50 sq. in. section; our boxing about 16 sq. in. timber section, while neither would have to be carefully aligned. The piping could be jointed in full lengths, no cutting being necessary.

There is also economy in placing that portion of the apparatus which is within the tower. The lever frame in the manual system has to be erected complete in the shop where it is built, marked, taken apart and re-erected in place. The pneumatic frame is erected, tested and shipped complete to destination.

The *economy in time of operation* can best be shown by tabulation. The figures below have been obtained by direct observation and experiment.

In comparing the speed of action for the different systems, it should be observed that the figures here given for the manual system (as exemplified at Thirty-sixth street) cannot be improved on; while the speed of action for the pneumatic system is entirely dependent on the air pressure used in working the apparatus: the higher the pressure the quicker the movements. The Mantua system was worked on 20 lbs. pressure.

In determining the best working pressure to be used, a compromise had to be made between economy in time of operation and economy in amount of air pumped and drawn off. At Mantua, 20 lbs. air pressure accomplished a working which was sufficiently prompt for ordinary business. The operator could, however, at his discretion, use any pressure up to about 60 lbs., the limit imposed by the capacity of boiler and pump used at that place.

TABLE OF SWITCH AND SIGNAL MOVEMENTS.

NOTE.—The intervals are all given in seconds, reckoning from turning cock-handle in pneumatic apparatus or depressing treadle in manual apparatus.

SWITCHES.

Pneumatic System (20 lbs. pressure).				Manual System.			
Switch.	Distance from tower along connections.	Rails moved and locked.	Indication complete.	Switch.	Distance from tower along connections.	Rails moved.	Rails moved and locked.
No. 1 (stub)	90 ft.	1½	3	No. 11 (Lorenz)	215 ft.	....	8
No. 2 "	405 "	3½	7	No. 13 "	200 "	4	....
No. 3 "	445 "	4	8	No. 7 "	340 "	....	8
No. 4 (Lorenz)	630 "	7	14	No. 6 "	325 "	4	....
All four in quick succession	....	7	14	All four in quick succession.	....	....	18

SIGNALS.

Pneumatic System (20 lbs. pressure).					Manual System.		
Signal.	Dist'nce along connections.	Direction of motion.	Signal moved in.	Indicator moved in.	Signal.	Dist'nce along connections.	Moved either way.
N. Y. Home	282 ft.	Up	3	5	No. 1 (Home)	100 ft.	2½
		Down	5	10			
N. Y. Distant.	600 "	Up	5	....	No. 2 (Dist.)	2,000 "	4
		Down	10	....			
"Cen." Home	600 "	Up	6	15	No. 3 (Dist.)	1,050 "	4
		Down	30	40			
"Cen." Dist.	1,135 "	Up	9	45	No. 4 (Home)	593 "	3
		Down	42	60			
"Phil." Home	35 "	Up	¾	1½	No. 5 "	514 "	2½
		Down	2	4			
Frt. Home	66 "	Up	1¾	3½	No. 9 "	280 "	2½
		Down	2	4			
Frt. Home	356 "	Up	2½	5	No. 14 "	275 "	2½
		Down	6	12			
					No. 15 "	540 "	2½
					No. 16 (Dist.)	2,100 "	4

NOTE.—The New York distant signal (pneumatic system) has no return or indicator pipe.

In observing the figures of *switch movements* (in the preceding tabulation) irrespective of their indications, it will be noticed that the pneumatic system is quicker for all but one switch, and that in two cases out of four the switch is moved, locked and indication complete in the same or less time than when moved and locked *without any indication* by the manual system.

But the most marked difference of time consumed is in the case of combinations involving the movement of *all four switches*. Here 14 seconds suffices, in one system, for the movement, locking and indication of four sets of rails, against 18 seconds, in the other system, for the movement of the same number of switches, two of them only being locked and indication received from none.

In the figures for *signal movements* the pneumatic system seems to suffer. But the home signals all move reasonably quick, two of them sooner than by the levers, one in the same time, one in one second later, while the fifth ("Cen." Home) is tardy in its action from very good reasons. That home signal and its corresponding distant signal receive their air supply from the same pipe; whence the fact that the home signal does not move until nearly the whole length of piping to the distant signal (1,135 feet) has been charged with air at the requisite pressure.

The tardiness of the downward movement of the signals is due to the fact that it does not begin until the pressure in the pipes has fallen off from full boiler pressure to the pressure due to the weight of the piston signal and attached counterpoise; while, again, the indication is retarded in the same manner, until the pressure under the indicator piston is reduced to a similar extent.

An improved arrangement is suggested, whereby the *distant-signals*, when such are used, should be of the Rousseau electric pattern, and be worked by a circuit-closer attached to and operated by the home signal. An electric indicator being placed in the tower, and connected with the distant signal, its striking would be conclusive proof that both home and distant signals had done their work, comformably to the intention of the operator, and the indication would be practically instantaneous.

The *concentration of moving parts*, previously alluded to, is a manifest advantage. In the manual systems the moving parts are principally in the form of connections, ramifying in all directions from the tower, mostly underground, and are liable to serious derangement from various causes. Moreover, these connections are the most vital part of the machine, inasmuch as the relations of movement between the levers and the switches or signals are entirely dependent on their good and perfect condition.

In the pneumatic system the moving parts are concentrated at the terminal points of the connections, where they can be readily reached, oiled and kept in order.

The applicability of the pneumatic system to the movement of *switches* and *semaphore signals* gives it a decided advantage over any electric system which can ever be offered, and its characteristic feature of return indications places it in advance of all manual systems, in that one particular at least.

The effect of extreme cold weather on the air in the pipes can only be conjectured, as the apparatus at Mantua was in operation only during the season of Centennial traffic. Engineers and practical men, who inspected the Mantua apparatus, gave conflicting predictions on this question; and nothing short of a practical test in winter weather will answer it conclusively.

Provided it stands the cold weather test, the pneumatic system promises to be preferable to others for terminal points, yards, etc., where it would be objectionable to erect large buildings for housing levers, and unsightly and inconvenient to clutter the ground with boxing, etc., where concentration of parts would be a desideratum and compressing apparatus could be readily maintained.

At isolated junctions, where but a small number of levers would be needed, and at places remote from populous centres, the manual system will probably be found preferable.

The Translations of Weyrauch.

NEW HAVEN, Conn., May 30, 1877.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I hear from various sources, and in fact it is openly stated in the last number of the *Journal* of the American Society of Civil Engineers, that I am the translator of one of the editions of Weyrauch's "Strength and Determination of Dimensions of Iron and Steel Structures," a review of which you gave in your issue of May 4. As a matter of self-defense I wish to say, through your columns, that I have not translated that work or in any way aided its publication.

Your reviewer mentioned, indeed, both translations, but he omitted to state—and this, I think, is of some importance to readers—that one edition is authorized by the author, while the other is published against his expressed wish. Prof. Weyrauch has produced a book containing clear and concise statements of the general results of experiments on the strength of materials. To examine the original records of experimenters in Germany, England, Sweden and America, to divest them of tedious technical details and place the essence in a compact form, so that the engineering student may in a few hours learn what years of experience and experiment have taught regarding the properties of iron and steel, was not an easy task, but required long and patient labor, which readers—and certainly purchasers—of his book ought to respect. The octavo edition translated by Prof. DuBois was published at his desire, has enjoyed the benefit of his revision, and he receives some pecuniary compensation for every copy sold. The duodecimo edition, with which my name has been connected, is published not only without his consent, but against his wish. It is an axiom that every workman has *some* property right in the product of his labor, yet most American publishers claim that foreign authors have no rights!

But this is not the only difference between the two editions. The translation by Prof. DuBois (xi.+ 210 octavo pages) contains excellent tables for the reduction of metric to English measures besides many reductions in the text, has a lengthy appendix by Prof. Thurston, and preserves carefully Weyrauch's numerous foot-notes containing references to original literature. That of the unknown translator (112 duodecimo pages) has neither reductions nor reduction tables, the references to literature have been entirely disconnected from the text—by which they lose one-half their value—and it contains numerous errors of translation and of printing.

These points, it seems to me, ought to be known.

MANSFIELD MERRIMAN.

MASTER MECHANICS' ASSOCIATION.

Report on Feed-water and Incrustation.

To the American Railway Master Mechanics' Association:

GENTLEMEN: Your committee appointed to report on the "Best Point in the Boiler to introduce Feed-water, and the Cause and Prevention of Incrustation in Boilers," submit the following:

We think the best point in the boiler to introduce feed-water is the usual one on nearly all American locomotives—a point near front flue-sheet, at central line on side of boiler. The injection of feed-water near highly heated plates is undoubtedly injurious to them and liable to cause their rupture, because the surface near which the feed-water enters the boiler loses its heat more rapidly than do the surrounding parts; hence there is an inequality of temperature and consequent unequal strains. At the point of injection designated as the proper one there are no highly heated surfaces for the feed-water to have immediate contact with. Impurities held in solution in water are precipitated by heat, and if feed-water is injected as far as possible from the furnace, it is fair to assume that it will precipitate some of its solid matter before reaching the highly heated plates of the furnace. In recommending that the point of injection be as described, we of course assume that in all cases the lowest water-level is above the central line of boiler. We do not think the feed-water should be injected into the steam-space under any circumstances.

Your committee have not had analysis made of different kinds of water to determine the component parts of the impurities held in solution. This branch of the subject has been fully treated by many able chemists and writers. The practical part is all your committee feel in the least degree able to discuss, and therefore they will confine themselves to the three following branches of the subject of boiler incrustations:

1st. Effect of incrustations on the consumption of fuel.

2d. The effect on life of furnace sheets and outside shells and flues.

3d. Remedies and their cost.

The increase in the consumption of fuel on account of incrustations on the heating surface of boilers varies with the thickness and density of the deposit. When porous, the water will penetrate it, but when hard and compact it presents a complete barrier to the contact of the water with the heating surfaces. As incrustations are poor conductors of heat, an increased consumption of fuel is inevitable when they exist. To determine the percentage of increase in the practical operation of locomotives, your committee present the following table, showing the average miles run to one ton of coal by engines for three months prior to and for three months after the removal of incrustations from the boilers. Your attention is called to the fact that 120 cases are given of engines on the Illinois Central Railroad during the last three years. In many cases the same engine is given two or three times, because during the period stated it was necessary to clean the boilers that often. The general average of the 120 cases cited show an increase of 11 per cent. in the consumption of coal for the three months prior to the boilers being cleaned, as compared with the three months immediately succeeding:

No. of engine.	Date when cleaned.	Average miles run per ton of coal before cleaning.	Average miles run per ton of coal after cleaning.	No. of Engine.	Date when cleaned.	Average miles run per ton of coal before cleaning.	Average miles run per ton of coal after cleaning.
8	Aug., 1875.	41.48	49.74	105	June, 1874.	23.66	28.07
21	Jan., 1876.	27.29	36.82	105	Dec., 1875.	25.23	28.70
23	Oct., 1874.	40.51	37.25	109	July, "	25.21	34.14
23	Aug., 1876.	36.58	33.67	110	May, 1874.	27.79	29.37
26	Jan., 1874.	37.35	33.76	110	Oct., 1875.	26.13	28.39
26	Oct., 1875.	40.02	39.21	128	June, "	35.24	41.34
26	Sept. 1876.	40.10	39.24	132	Oct., "	32.01	35.00
28	April, "	45.80	41.12	135	March, "	30.95	33.89
34	Jan., "	42.26	46.83	137	Jan., "	39.45	42.17
35	July, 1875.	36.42	40.45	138	Sept., 1876.	47.79	45.31
35	" 1876.	37.56	37.59	139	June, 1875.	26.38	29.62
36	Aug., 1874.	42.38	37.36	140	Nov., "	28.69	28.20
37	Jan., 1875.	32.24	39.98	140	Aug., 1876.	34.30	27.26
43	April, "	40.88	49.08	141	Jan., 1875.	29.11	36.62
44	Jan., 1875.	36.87	42.57	142	" "	25.78	31.77
46	Oct., 1874	34.52	40.46	143	March, 1875.	27.67	35.75
47	Feb., 1876.	25.30	51.51	144	" 1874.	27.91	34.09
48	Oct., 1875.	33.88	36.10	146	Jan., "	26.74	34.89
52	July, 1874.	37.85	36.38	147	Aug., "	25.72	30.26
52	Jan., 1876.	43.35	43.35	148	" 1876.	29.21	34.68
57	March, 1874.	39.37	41.35	149	March, 1874.	22.41	31.90
57	June, 1876.	44.77	47 34	152	Dec., 1875.	25.68	34.51
65	Jan., 1875.	35.47	50.55	155	Jan., 1876.	31.33	38.24
69	Nov., 1874.	37.00	38.13	159	Dec, 1874.	29.16	32.36
76	March, 1875.	30.08	38.81	161	June, 1875.	37.06	47.26
76	" 1876.	27.04	23.19	162	Jan., "	37.84	49.31
77	Jan., 1874.	20 33	24.15	165	" 1876.	41.18	46.98
78	Oct., "	35.54	34.82	166	July, "	34.75	40.54
78	July, 1875.	29.82	32.29	167	March, 1875.	33.56	43.10
79	March, 1874.	28.87	27.69	168	" "	28.54	34.25
80	April, 1876.	25.35	44.09	169	Jan., 1874.	22.87	39.62
81	Jan., 1874.	22.88	22.26	169	Nov., 1875.	35.57	38.89
81	" 1875.	27.10	27.97	170	" 1874.	25.97	32.27
82	May, "	29.16	34.78	171	April, 1876.	30.04	35.86
83	Jan., "	23.14	35.74	172	March, 1874.	27.34	29.16
83	June, 1876.	29.81	33.99	172	Aug., 1875.	28 06	26.47
84	" 1874.	24.29	31.44	172	Oct., 1876.	31.96	35.58
84	Feb., 1875.	30.73	45.68	173	Aug., 1875.	31.84	32.83
85	Sept., 1874.	24.71	29.06	174	July, "	31.58	36.41
86	Aug., "	29.43	34.73	174	Feb., 1876.	30.12	29.08
88	May, 1875.	21.42	32.20	174	Nov., "	27.48	22.72
90	" "	33.57	40.62	177	Feb., 1874.	21.98	24.38
91	July, 1874.	22.18	26.72	177	" "	23.60	28.86
91	Dec., 1875.	24.96	25.53	178	" "	29.49	28.78
92	April, 1874.	24.79	29.69	179	March, "	28.20	38.18
92	" 1875.	28.72	26.42	180	July, "	30.26	34.11
92	July, 1876.	30.51	23.79	181	June, 1875.	33.83	36.46
94	June, 1874.	30.06	36.31	183	July, "	33.10	33.93
94	July, 1876.	33.84	29.09	184	March, "	28.15	31.65
97	April, 1875.	25.56	37.47	185	Aug., "	35.78	31.51
97	May, 1876.	36.93	38.87	186	" "	34.90	31.05
98	April, 1874.	24.42	32.81	187	July, 1875.	34.95	35.07
98	Nov., 1875.	30.32	33.03	188	Nov., "	32.68	29.90
99	Sept., 1874.	38.49	38.42	189	Sept., "	34.90	32.07
99	Nov., 1875.	37.86	34.73	191	Aug., 1876.	28.42	28.75
99	June, 1876.	37.29	31.73	193	Sept, 1875.	30.18	29.38
100	May, 1875.	26.30	32.56	194	Aug., "	26.50	29.43
102	Feb., 1874.	20.53	31.45	195	May, "	25.72	30.01
102	March, 1876.	21.05	32 00	196	March, 1876.	24.84	33.98
103	Aug., 1875.	25.67	32.31	197	July, 1875.	26.07	28.90

General average before cleaning, 30.04; after, 34.49 miles.

By examining the table in detail, it will be seen that in some cases engines ran less miles per ton of coal with clean boilers, but in nearly every instance it is due to the difference in the weather. For instance, an engine running during August, September and October with an incrusted boiler, and during December, January and February with a clean one, would give the result stated, because the first three months were warm and the last three cold winter months. We do not wish to deal with individual cases, however, in this branch of the subject, but with the general result obtained from a large number of engines. We feel justified in saying that the average of 120 cases, under all circumstances of weather, etc., may be taken as an index of the practical effect of incrustations on the consumption of fuel.

Mr. Reuben Wells, Master Mechanic of the Jeffersonville, Madison & Indianapolis Railroad, in an interesting letter to your committee, gives the result of his investigations on the effect of incrustations on consumption of fuel. The cases cited are of two passenger and two freight engines on the main line of road. He says:

"The two passenger engines were of the same size and pattern, having cylinders 16×22 in. and drivers 5½ feet diameter, and were run with the same trains on alternate days. The coal was weighed as put on the tenders, and the engines were run and fired without any reference to a test or trial, and without the men knowing that trials were being made. The results given are from the ordinary, every-day working of the engines, subject to the usual delays, inclement weather, etc., occurring in conducting the business throughout the year. Passenger engines Nos. 10 and 11, referred to, were run during the same time and on the same trains. From the time the boilers were new until the tubes were removed and boilers thoroughly cleaned they had made an average of 100,779 miles each. They then commenced running again, comparatively clean, and made an average of 34,047 miles; then in the six succeeding months November to April, inclusive, a further mileage of 20,048 miles, making a total of 54,095 miles since the boilers were cleaned,

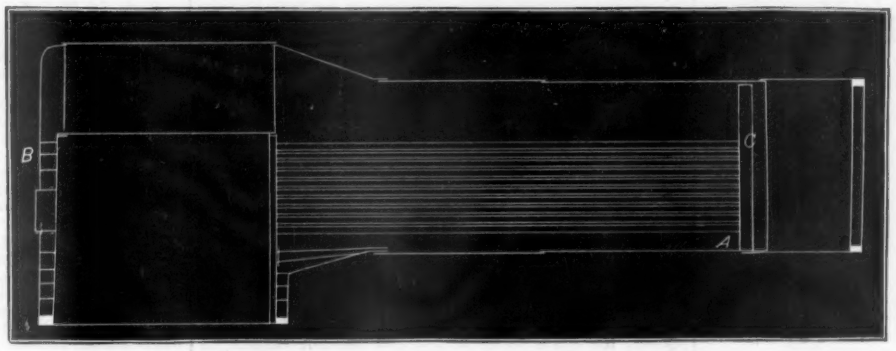
and while running the 20,048 miles, when considerable incrustation was on the tubes and fire-box sheets, the consumption of coal averaged one ton to 42.33 miles run. The tubes were then taken out of both boilers and the heating surfaces cleaned of scale as thoroughly as could be under the circumstances, and both engines ran again for six months, July to December, inclusive, making an average of 20,691 miles, consuming one ton of coal for every 49.77 miles run, showing a difference in favor of clean heating surfaces of 17⅓ per cent. A part of this is due to a difference in the weather at the time the tests were made. In the first case the test extended through the winter, while in the latter case it was partly during the summer months. In comparing the coal used by these two engines during two winter and two summer months, under the same conditions as to scale in the boilers, the difference was 4 per cent. in favor of the summer, due, of course, to the higher temperature of the atmosphere. In the case of the six months' trials given, one was not all in the summer nor the other entirely in the winter months, therefore 4 per cent. difference, owing to different atmospheric temperatures, would not wholly apply. We may assume that of the 17⅓ per cent. difference in consumption of fuel between clean and incrusted heating surfaces, about 2 per cent. was due to temperature and 15⅓ per cent. to the effects of incrustation."

In a similar manner Mr. Wells shows that two freight engines gave a difference of 26 per cent. in favor of clean heating surfaces, less 4 per cent. due to the different atmospheric temperatures under which the tests were made, thus giving a net saving of 22 per cent. in favor of clean boilers, on two freight engines on his road. The difference of 22 per cent., he states, was borne out on his comparing three months' service of clean with three months' service of incrusted boilers, the average atmospheric temperatures being about the same during each period of time. While the results obtained by Mr. Wells from his experiments are much higher, and show a great difference, when compared with those on the Illinois Central Railroad, your committee see no reason for doubting the accuracy of either. It is reasonable to believe that the nature of the incrustration affects its capacity to conduct heat, which again must affect the consumption of fuel. Different waters, having dissimilar impurities in solution and suspension, must cause differences in the comparative consumption of fuel, with clean and incrusted boilers. Impurities held in suspension no doubt affect the free evaporation of water, because they impede the ascension of steam globules from the heating surfaces of the boiler to the surface of the water. The phenomena must be similar to those seen when boiling in an open vessel water thickened with meal or bran. The globules of steam cannot ascend freely, but accumulate in the thickened water, generally in the part exposed to the greatest heat, and raise the surface of the liquid in the vessel above its natural level. To illustrate the extent to which the quantity of solid matter held in solution may vary in the different waters used on a line of road, we give the following table showing the amount of solid matter contained in water taken from thirteen water stations on the line of the Illinois Central Railroad:

Lake Michigan water	18	grains	per gallon
Kankakee River "	20	"	" "
Gilman water station	15	"	" "
Champaign, north tank	20	"	" "
" south "	34	"	" "
El Paso water station	30	"	" "
Rutland " "	70	"	" "
La Salle " "	20	"	" "
Mendota " "	84	"	" "
Waterloo " "	13	"	" "
Ackley " "	25	"	" "
West Fork " "	18	"	" "
Fort Dodge " "	15	"	" "

The foregoing quantities were obtained by evaporating one gallon of water from each place and weighing in delicate scales the solid matter left in the vessel. It was found that equal weights of the different deposits varied greatly in bulk, some being from two to four times greater than others. To determine the loss per year to a railway company on account of the additional consumption of fuel due to incrustations in locomotive boilers, is a difficult matter. As soon as a clean boiler is put in service, deposits commence forming and increase daily; therefore a comparison of the miles run per ton of coal for three months before and three months after a boiler is cleaned gives results only approximately correct. It simply shows the difference in consumption of fuel between a boiler having considerable scale in it and one with a less amount. A boiler will not remain clean for three months if water is used which contains impurities held in solution, and for this reason the facts we arrive at in making our experiments are merely of relative value, and cannot be considered as furnishing data from which we can arrive at accurate results respecting the economy of a perfectly clean boiler. We have no means of knowing to just what extent a very thin deposit on the heating surfaces affects the generation of steam, nor can we tell whether a heavy deposit will affect a boiler in the same manner as a light one, the difference being one of degree; whether as the incrustations accumulate new destructive agents are not developed, which by the subtlety of their action escape ordinary observation. This inquiry, however, relates more properly to the nature and composition of the scale and its chemical influence, a subject we relegate to the consideration of others better prepared for its investigation; but the ultimate effects of these destroying forces, and the ones which concern us most, their bearing on the consumption of fuel and direct influence on the deterioration of the boiler, command our earnest attention. If we assume 11 per cent. as the increase in fuel on the Illinois Central Railroad due to incrustations in boilers of locomotives, we find a loss in money of about $33,000 per year, the amount of coal used during 1876 being taken as a basis. About 141,000 tons of coal were used by locomotives on that road last year, costing about $300,000, 11 per cent. of which amounts to the sum named. On other lines of railway the waters of which contain a greater average quantity of solid matter in solution, the percentage of loss will be proportionately greater. Waters containing floating impurities do not entail so great a loss, as the deposits are more of the nature of mud and can be blown or washed out.

The next branch of the subject which we will consider is the effect of incrustation on the life of furnace sheets, and of outside shell, and of flues. As the action of incrustations is closely allied to the effects of the unequal strains to which the different parts of boilers are subjected, we will, in treating of this matter, consider the influence these forces exert on the different sheets independently and conjointly. It does not matter at what particular time a sheet sustains an injury, whether in the process of manufacture, resulting in a defect of homogeneity, or during the construction of the boiler, in being flanged and worked, or while in service, from unequal expansion and construction. If the injury strains or disturbs the fibres, or abrades the surface of the plate in such manner as to expose the metal underneath to the action of the water, the acids and salts immediately act on the plate and commence their gradual and sure work of destruction. The wear and tear of boilers is due to the action of mechanical and chemical forces, external and internal. The internal action of these forces, so far as they are related to the matter in hand, is the subject to which your committee invite attention. As the crown sheet of the furnace is the most highly heated plate in a locomotive boiler, and as the circulation of water over the crown is necessarily imperfect, owing to the numerous crown-bars, bolts and braces above it, the deposits of incrustation are heavier on it than on the sheets. The amount is increased by that which falls from the bars, braces and upper parts of the boiler and lodges between the crown-bars. The effect of the scale accumulating in this manner on the crown is the over-heating and bulging of the crown sheet between the crown-bolts, making the holes oblong, causing the bolts to leak and the sheet to crack. On the Illinois Central Railroad the average life of steel crown-sheets is about three years, or about half the life of the furnace. The back flue sheet, when made of iron or steel, is the next sheet most affected by scale. On account of the poor circulation of water between the flues, and the intense heat applied to them, the scale forms on the sheet between the flues and that part of the sheet becomes overheated; the heating and cooling and the unequal expansion of different parts of the sheet and of the flue ends cause the metal to crack between the flue holes. The short braces under the flues, staying front of furnace to waist of boiler, are generally covered with a heavy deposit of scale. Situated directly under the flues, in a position to intercept the deposition of impurities and close to a highly heated plate, the conditions are favorable to the accumulation of scale, which, gathering at the foot of the braces next to the flue sheet, excludes the water and leaves that part of the sheet exposed to the action of the fire. The result is that numerous cracks are formed in the sheet near these braces, which greatly assist in its destruction. We find that the life of the back flue sheet is shortened about 33 per cent. by the incrustations. The side sheets of furnace when made of steel are liable to crack from the combined action of the strains due to unequal expansion and contraction, augmented by the formation of scale on the water sides of the sheet. Owing to the limited water space on each side of the fire-box, the rapid evaporation and vigorous circulation of the water confined therein, due to the intense heat applied to the lower part of the sheet, the amount of scale deposited on the furnace sheet seldom exceeds a thin coating; but on the side sheets of outside shell, near which the disturbance is less violent, and on the stay bolts, the deposit is much heavier. On the upper part of the stay bolts we generally find a much greater amount of scale than on the lower part or at the sides; this is due to that portion of the bolt being protected somewhat from the upward current in the circulation, and the tendency of the particles of solid matter to seek the more quiet places for deposition, together with the accumulation of impurities which float on the surface and are deposited on the upper side of the bolts each time the water is drawn off in blowing out boiler. The heat retained in the stay-bolts after the water is drawn off hardening this deposit, it gradually works along to the furnace sheet, and gathering along the bolts at their connection with the furnace the deposit increases in size and density until finally the water is excluded, and the places at which this occurs are left exposed to the influence of the fire. The result is, that at the lower central part of the sheet where the action of the fire is most severe, small cracks radiate from the stay bolts, and growing large sometimes necessitate a renewal of the sheet. Patching is frequently resorted to in an endeavor to prolong the life of the sheet, but the difficulty in keeping patches tight when in such an exposed position, usually makes this practice unsatisfactory. By frequent washing out, the water spaces around the furnace may be kept comparatively free from deposits, and the sheets will not bulge, but if large deposits are allowed to form, the bulging will take place. Copper sheets are very liable to bulge in this way if washing out is neglected, and the projecting parts are cut away by the action of the fire and fine particles of coal. It sometimes happens when cleaning the braces and crown of furnace that large pieces of scale become detached and, falling into the narrow space between the side sheets, are caught on the stay bolts, and escaping notice from the difficulty of examining thoroughly that part of the boiler, are allowed to remain, and form a shelf on which deposits are formed, and the subsequent washings of the crown accumulate until, in the course of time, the space between the inner and outer shells at the point where this shelf is located is filled solid, and the water entirely excluded from the sheets. This deposit of scale becomes thoroughly heated and baked, and when the boiler is blown out retains its heat for some time after the surrounding parts are cool. The consequence is, a strain on the sheet which eventually works its destruction. Cases where side sheets of furnaces have suddenly cracked when the engine was standing in house, and sometimes after the boiler had been blown out, have been traced directly to such accumulations of solid matter in the water space between the sheets. We cannot, however, charge a circumstance of this nature to the formation of scale under ordinary conditions; but as it is one of the accompanying evils due to the presence of scale, it must be included as one of the many forms in which incrustations work their destructive influence. The left side sheet is worn away to some extent by the coal thrown against it in firing the engine, and for this reason rarely lasts as long as the right one. The stay bolts between the inner and outer shells of furnace, owing to the nature of the surface they expose, its peculiar susceptibility to the action of the acids, are sometimes wasted away in grooves near the furnace sheet by impurities of the water. That part of the sheet immediately around the bolts is often affected in a similar manner, in consequence, no doubt, of the injury to the fibre of the metal in punching the holes for the stay bolts. For this reason the drilling of stay-bolt holes is preferable, there being less liability of injuring the plate. Evidence of the combined action of mechanical and chemical forces may be seen in the upper stay bolts, which usually waste away quicker than the lower ones; the furnace expands more than the outer shell of fire-box, because it is subjected to greater heat, and as the inner and outer shells expand unequally in the direction of the height of furnace, the upper stay-bolts are strained more than the lower ones; it is really a slight bending back and forth of these bolts as the boiler is heated and cooled, which of course disturbs the fibre of the metal, allowing the water and its impurities to gradually do their destructive work.

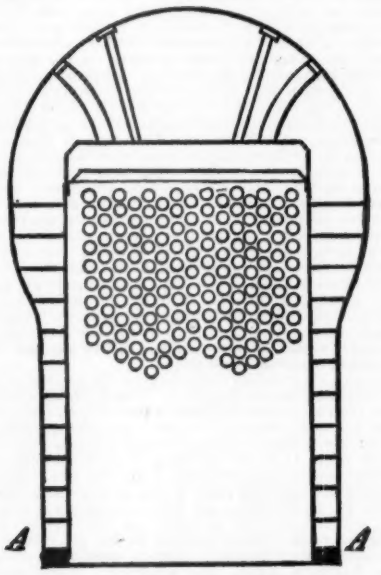


The strains brought to bear on the front flue sheet by the longitudinal expansion and contraction of the flues and furnace, attending the alternate heating and cooling of the boiler, are concentrated in the corner of the flange sheet. The outside shell is not as highly heated as the furnace and flues, and therefore does not expand as much.

On the diagram the strain resulting from the expansion of furnace and flues tends to bulge out the sheets *B* and *C*, and when the boiler is cooled the contraction draws them in, and of course throws the strain on the bend or corner of the flanges, disturbing the grain of the metal and opening the way for the corrosive effects of the acids in the water, which in the course of time furrows the flue sheet at the corner of the flange, *A*, below the water line. From the weakening effect of the corrosion, cracks are developed extending partially or wholly through the plate.

From front flue sheet to the back sheet of boiler is virtually a continuous structure, the intermediate parts being the flues, furnace sheets and stay-bolts. On the back sheet of boiler, where the flange is not as sharp nor the strains as severe as on the front flue sheet, the vertical furrows which appear below the water line are usually a much longer time in forming and are not as heavy as those formed on flue sheet.

The bottom of the cylindrical part of boiler inside is also attacked by the impurities in the water, especially around the curvilinear seams close to the lap. In four or five years these sheets need half renewing or patching, if the material in them has not a good surface to resist the acids and salts. The action of these destroyers is aided by the fact that in firing a boiler the upper part is heated first and becomes hotter than the lower part even after steam has been raised. Now, as the upper part of the boiler becomes hot and expands, the strain is thrown on the rivet seams of the lower part; this strain disturbs the grain or fibre, as already described, and the caulking and riveting; hence the metal is corroded more readily near the seams than in the body of the sheet where the surface of the metal is good and grain or fibre unimpaired. The pitting or local corrosion, on the inside of sheets, found in holes and patches varying from ¼ inch to several inches in diameter, and from 1/32 to 1/16 inch deep, is due no doubt to the fact that the skin of the metal is imperfect, or perhaps the metal itself is a little softer at places where this occurs than elsewhere in the same sheet, and the chemical forces readily act upon it. It is noticeable that in all cases where water containing impurities in solution is used, and through some imperfection gets under the skin or hard surface of the iron or steel, it eats its way gradually, but surely.



The side sheets of the outer fire-box of locomotive boilers frequently furrow just above the bottom ring of furnace, or inside of sheet, at points marked *A*, *A* in diagram. The cause of this furrowing we trace to the fact that the upper part of the inner and outer fire-boxes becomes hotter than the furnace ring, which is usually below the fire and always comparatively cool. The upper part of the furnace expands transversely as well as longitudinally and vertically, and in the transverse expansion throws a bending strain on the sheets at the points *A*, *A*. By the alternate heating and cooling of the boiler, the fibre or grain of the metal at this point is disturbed and the way opened for chemical action, as already described. This is more noticeable with iron than with steel sheets, because the metal in iron sheets is not so close.

The combined action of the mechanical and chemical forces in boilers is also manifested in the corrosion and cracking of the throat sheets, especially in wagon-top boilers. Owing to the usual method of bracing the forward and back part of locomotive boilers to the main frames a portion of the force exerted by the expansion and contraction due to heating and cooling is expended in buckling and pulling on the throat sheets, and part in springing the braces extending from frames to boiler. The action specified in the throat sheets disturbs the fibre or grain of the metal, and as the strains concentrate in the weakest points, the rivet seams are the first to give trouble. Chemical action sets in, as in the other cases, and furrows the sheets near the lap, eats pitholes or pockets in the plates, and at length results in cracking or rupture, unless proper precautions are taken.

The flues accumulate heavy deposits of incrustation, owing to the feeble circulation about them. The salts and acids from pitholes on the outside, and the fire, gases and particles of coal attack them on the inside. With very impure feed-water deposits are formed around the flues in such quantities as to fill the space between them, and the result is, they not infrequently collapse.

To remove the incrustations it is necessary to take out the flues, which necessitates piecing the ends before replacing them in boiler.

The life of flues is no doubt shortened from 33 to 50 per cent. by the action of the impurities in the water, and the necessity which compels their removal to clean off the incrustation.

In view of the facts stated above, we believe it to be economy

to use flues not less in thickness than No. 11 wire gauge for coal-burning locomotives.

REMEDIES AND THEIR COST.

We have seen that the destructive forces acting on the internal surfaces of the plates of boilers are mechanical and chemical; that the effect of these forces is not speedily destructive, except where they are combined; that the chemical force is strongly resisted by the surface of the metal, and has but little effect where the plates are free from inherent imperfections and the action of mechanical forces. For the mechanical action there is no positive remedy; but it can be lessened by a careful construction of the boiler with a view to equalize the strains so far as possible, and not have them concentrate unduly at any one point. Thorough examination of boilers should be made whenever possible. All the incrustations should be removed, and chipped or scraped off the interior of the boiler in all its parts, especially around the rivet seams and at the edges of the laps, so that a thorough inspection may be made. The only safeguard is inspection, in the fullest and most complete sense of the word, of all the parts of a boiler and its stays, braces, laps and rivet seams, in detail.

Your committee cannot recommend any boiler compound or anti-incrustator, so-called, for preventing the formation of scale in locomotive boilers. At least thirty different compounds have been tested on the Illinois Central Railroad: none of them proved beneficial. The last trial was concluded March 29, 1877, having been commenced October 26, 1876. The compound was well recommended, but proved almost valueless. About 115 gallons were used during the trial, and when the engine was laid in for repairs, and the flues removed, the usual amount of solid matter was found. In some places the scale seemed to be softened a little; but for cleaning incrusted boilers on the Chicago section of the Illinois Central Railroad, it was a failure.

Your committee submit that the impurities held in solution and suspension in water differ widely in different localities, and what may affect the incrustation from one kind of water will not affect that formed from another. In fact it appears that the incrustations taken from the same boiler differ in component parts according to the locality from which they are removed. This is shown by the following analysis of scale taken from the flues, and from a crown-bolt head of engine No. 193 on the Illinois Central Railroad:

COMPONENT PARTS.	SCALE FROM FLUES.	SCALE FROM CROWN-BOLT HEAD.
Iron sesquioxide	1.010 per cent.	0.650 per cent.
Alumina	1.390 "	0.200 "
Silicium (silica)	13.475 "	7.737 "
Baryta	traces.	traces.
Carbonic acid	undetermined.	undetermined.
Organic matter	"	"
Chlorine	.561 per cent.	.150 per cent.
Sulphuric acid	1.784 "	2.306 "
Potassa	.481 "	.057 "
Calcium (lime)	16.959 "	17.800 "
Soda	.795 "	.479 "
Phosphoric acid	.319 "	.319 "
Magnesia	25.145 "	25.292 "
Water	1.850 "	1.025 "

In the boiler from which this scale was taken, a so-called "anti-incrustator" had been used for about two months, which will account for the presence of some of the component parts given.

In this connection your committee submit the following letter from Mr. D. F. Mahla, an eminent chemist of Chicago, to the Vice-President of the Illinois Central Railroad:

"*Office of Mahla & Choppell, Manufacturing Chemists,*
"CHICAGO, Feb. 6, 1877.

"*W. K. Ackerman, Esq., Vice-President Illinois Central R. R.:*

"DEAR SIR: I have completed the analysis of boiler incrustation and append the result, viz.:

Sulphate of lime	51.333
Carbonate of lime	14.023
Carbonate of magnesia	20.373
Carbonate of iron	2 656
Silicic acid	0.401
Combined water and organic substance	11.214
	100.000

"To prevent such incrustations it would be necessary to decompose the lime salts in water before introducing in boilers. This could be accomplished with but little difficulty by adding to the water a proper equivalent of lime water to precipitate the carbonate of lime and subsequent addition of carbonate of soda for the sulphate of lime. The process is very simple and comparatively inexpensive, and should you desire a formula for doing so, it will afford me pleasure to communicate it; but the practical difficulty that your water stations are so numerous, and the uncertainty of securing proper attention by the tank men, may prevent the practical application of the only plan to secure satisfactory results. Should the preceding plan not be adopted, then the only recourse is to remove the incrustation after it is formed. Several expedients have been suggested to attain this result. The most expeditious and simple is probably the use of dilute hydrochloric acid, but the action on iron would *require much caution*, hence, could not advise using it. Among the many devices suggested for retaining the lime-salts in solution and for removing the incrustations already formed, without appreciable injury to boiler, I consider an addition of common salt with a proportion of muriate of ammonia to the boiler water as most economical and practicable. The lime-salts are better retained in solution by an addition of these two compounds, and the incrustation already formed would gradually dissolve, but the boiler ought to be daily blown off, when the incrustation could probably be prevented to a great extent. This however would require some preliminary experiments to calculate the proper quantity of saline matter to be used by a locomotive boiler. An arrangement for introducing the salts above-mentioned, without rendering it necessary to open manholes, can easily be devised.

Yours very respectfully, D. F. MAHLA.

On the Chicago Division of the Illinois Central Railroad it cost to keep a boiler clean for one year as follows, half the flues being removed:

Removing and replacing steam pipes, and removing, welding and replacing half set of flues, and cleaning the boiler	$45 00
Labor and material, washing out boiler 52 times	26 00
Washing off crown sheet 12 times	14 00
Total per year	$85 00

Every second year all the flues have to be removed, entailing an additional expense of $35, making the average per year, excluding all deterioration of boiler plates, braces, stay bolts, &c., $102.50. This, it must be understood, is about the average cost of *simply cleaning the boiler* of the solid matter precipitated by the water converted into steam.

In conclusion, your committee beg to state they feel convinced that economy in use of fuel, and in maintenance of boilers, demands pure feed-water. We think we cannot too strongly urge the importance of locating water stations on railways at points where a supply of pure water, free from impurities held in solution or suspension, can be obtained.

Of the two classes of foreign matter, the grosser impurities are the least objectionable, because they can be blown or washed out of the boiler. When impurities held in solution are precipitated, they adhere to the heating surfaces, and mechanical force is necessary for their removal. If a natural supply of desirable water cannot be had, then, artificial surface reservoirs of sufficient size should be constructed. The capacity of these reservoirs can be determined by the rate of consumption, evaporation in air, average rain-fall, and average periods of drouth; and allowance can be made for contingencies.

If, however, a natural supply cannot be obtained, and surface reservoirs cannot be used for climate and other reasons, and it is an imperative necessity to use objectionable water, then your committee recommend the construction of suitable apphances for purifying the water before it is delivered to the locomotive tenders for use in the boilers. Various experiments may be devised for this purpose, as for instance, a condensing apparatus to evaporate the water and condense the vapor, from which apparatus the solid matter precipitated can be removed as occasion requires. Or, tanks can be erected, and lime-water used to precipitate the lime in solution. Or, the water can be heated to the boiling point and passed over extended surfaces of iron, on which the solid matter will precipitate.

Other methods suggest themselves, but your committee feel satisfied that the engineering and mechanical skill of railway men can readily devise a suitable appliance for each particular case. As before stated, different waters differ widely in the component parts of the impurities they contain, and each demands separate study and treatment.

Respectfully,
E. T. JEFFREY, Illinois Central Railroad.
H. L. COOPER, Ind., B. & Western R. R.
J. C. WILLS, Wabash Railway.

The Eastern Railroad Association's Experiments.

The Springfield *Republican* of June 4 says:

"A series of tests has just been finished with the dynagraph car on freight trains between this city and Worcester to ascertain the maximum power which the Nashville, the new and strongest engine on the road, could exert without slipping her drivers, and the results make it extremely probable that the Springfield engines are the strongest pullers of any pattern every made, as the following statistics, taken from Dynagraph Engineer Dudley's report to the Eastern Association, proves. The train was made up much heavier than usual, of 25 freight cars 900 feet in total length, 18 being loaded with grain and seven with oil tanks. The total weights in tons of cars and cargo were:

Grain, 211.5	Box-cars	180.0	=	391.5
Oil, 94.5	Oil-cars	65.1	=	159.6
	Dynagraph car	20.0	=	20.0
Mdse. 306.0	Cars	265.1	Total	571.1

The weight of engine with water, coal and two men was: On the drivers, 46,720 pounds; on the truck, 24,200; on the tender, 46,900; total, 117,900 pounds. The start was made from the river bridge; and to run 3,400 feet to the 98-mile post, just east of the Chestnut-street bridge, required 46,600,000 foot-pounds of power; that is, as much power was required to pull the train 3,400 feet as would be necessary to raise 46,600,000 pounds one foot from the ground. The next mile required 95,910,189 foot-pounds, the grade being 60 feet and the line tangent, or straight. The speed at the 98th mile-post was 14 miles per hour, but at the 97th only four miles, because of the heavy grade. The average tension upon the draw-bar for the last 1,000 feet was 18,300 foot-pounds; sand was used along the grade, and the drivers slipped but once. The speed of four miles an hour was maintained as far as the curve 800 feet east of the 97th mile-post, the average tension, however, increasing to 18,800 pounds, and, when full length on the curve, the locomotive stalled, though exerting a tension of 20,000 pounds at the time of stopping. The Nashville's boiler pressure ranged from 133 to 135 pounds. At 18 miles per hour on a level the average tension was 4,300 pounds, or 7.53 pounds per ton, a greater friction than with cars not so heavily laden and differently constructed; and at this speed a one-degree curve, 800 feet long, on a level, increased the tension to 4,800 pounds for 400 feet; a two-degree curve, 1,800 long, ran up the tension to 5,000 pounds for 600 feet, and two feet per second was lost in speed. At the Charlton grade, which ranges from 40.5 to 51.5 feet per mile, the power required on the 61st mile was 78,890,000 foot-pounds, the average speed being 10 miles per hour; on the 60th mile, 83,316,000 foot-pounds, average speed nine miles; 59th mile, 51.5 feet grade, 91,181,000 foot-pounds, average speed nine miles, and on the 58th mile, 81,936,000 foot-pounds, average speed 11 miles. The average tension on the tangent in this mile was 15,500 pounds, with a 49.1 foot grade, and a five-degree curve beginning in the eastern part of the mile, and ending in the 57th mile near Charlton. The power required on 1,400 feet of this curve in the 57th mile was 24,940,000 foot-pounds, the maximum tension on the curve at six miles per hour was 18,700 pounds, and sand was used on this grade as at Springfield, the drivers slipping but once on the five-degree curve. It was also found that adhesion is largely affected by the manner of admitting the steam to the cylinders, and the speed, as well as the condition of the rail and weight upon the engine's drivers, the last two elements being heretofore alone taken into account. The weather was clear, which is necessary to success in these tests, as wet weather causes a loss of about one-fifth of adhesion.

"No engine heretofore tested has shown so great a percentage of adhesion as the Nashville. This machine, 4,000 pounds heavier than any other on the road, has 4½ feet drivers, 18 by 26 inch cylinders, furnace 54 inches long, 41½ wide and 51½ deep, and the boiler is straight without a dome, and with 162 two-inch tubes 11 ft. 10 in. long. The steam-pipe is a thin four-inch copper tube perforated at the top with 1,500 eighth-inch holes, the throttle valve being in the smoke-box. The ports are 1¼ by 10 inches, and the valve-throw is five inches with ⅝ inch outside, but no inside lap, the narrow ports admitting the steam without a shock on the piston and making the pressure more uniform. This is certainly a triumph for Master Mechanic Eddy. The superiority of his engines as pullers, steamers, and for uniform pressure, as shown last summer in the trial with the Mogul engine Brown, is now practically beyond dispute. In the words of an enthusiastic employe, 'the old man's beat everything that's tackled him yit.'"

A Bullet-Proof Car.

The York *Evening Despatch* has the following description of the iron-clad passenger car recently built for the Spanish Government for use in Cuba by the Billmeyer & Small Co., of York, Pa., and now inspected and accepted by Colonel Sanchez, of the Spanish army:

Upon entering the large work-room on the second floor of the extensive shops, we saw before us what appeared to be an elegant passenger car—nothing peculiar about it except the beauty and taste with which it was finished. Upon closer inspection, however, we discovered that the car was in itself a steel-clad fort on wheels; a rifle battery, with embrasures.

In reference to the decorative portion of the work, it requires but a glance to show that this is not merely the work of a painter, it is the work of an artist. Every touch of the brush, every shade of color is laid on with an eye to its effect as combined with surrounding colors. Of a light buff in the body of the painting, the decorator has so ornamented and picked out this, with richer colors such as carmine, crimson and gold, as to give the delicate tint a yet richer appearance.

The steel slides which are pierced with loop holes for musketry and which take the place of windows have been so cunningly planned by the painter's skill to resemble the decorated ground glass, sometimes used in cars, as to deceive the unwary at a little distance.

Above the windows, in cardinal red letters, referring, as our readers will see, to the use to which this car is to be put, is the lettering, shaded with carmine and scarlet—"A. M. Ferro Carril Militar," and beneath the window in an ornamental lozenge, on one side the name of "Martinez Campos," and on the other side "Jovellar." The platforms and trucks are painted a beautiful chocolate color, and in painting the body miles of narrow striping have been used.

The car is 31 feet long, 8 feet wide, of the usual height, and is mounted on the Pennsylvania Railroad standard passenger car truck. Its weight is about 24,000 pounds.

Having finished our inspection of the exterior, we step inside, and here a renewed scene of beauty awaits us. Our feet rest upon an elegant oil-cloth, fresh from the establishment of Orne, of Philadelphia, and luxurious seats open wide to embrace us and give us rest; there are 20 of them, by the by, and we do not attempt to rest in them all at once, but we see that they are comfortable and costly, and that the seats, which are bent to fit the form, are of perforated birds-eye maple.

A partition divides the car into two portions, and through the half open, separating door, we see the glittering interior in its full length. The chairs are on pivots, and we swing for a better look. The trimming is rich and ornate; paneled head lining of light buff and violet, wood work of polished maple, walnut and cherry, here and there the delicately wrought Spanish arms, glitter of silvered lights, soft tints of color artistically laid on—could anything be more luxurious? The *tout ensemble* is perfect, and, we doubt that finer work in this line has ever been wrought.

General Railroad News.

ELECTIONS AND APPOINTMENTS.

Nashua & Rochester.—At the annual meeting in Nashua, N. H., May 31, the following directors were chosen. N. V. Whitehouse, Edwin Wallace, Rochester, N. H.; J. C. Eastman, Hampstead, N. H.; J. C. Burley, Epping, N. H.; A. H. Dunlap, A. W. Sawyer, Charles Williams, Nashua, N. H.; George P. Westcott, Portland, Me.; Charles H. Waters, Groton, Mass.; Charles E. Whitin, Northbridge, Mass.; Francis H. Dewey, Francis H. Kinnicutt, Charles W. Smith, E. B. Stoddard, Charles S. Turner, Worcester, Mass. The road is leased to the Worcester & Nashua Company.

Wabash.—On and after June 1 the office of General Purchasing Agent will be discontinued. All business relating to that department will be transacted by Mr. W. S. Lincoln, Resident Engineer.

Montreal, Portland & Boston.—Hon. Lucius Robinson is appointed General Manager in place of N. A. Smith, resigned.

Northern (New Hampshire).—At the annual meeting in Concord, N. H., May 31, the following directors were chosen: Josiah Minot, Onslow Stearns, Concord, N. H.; George W. Nesmith, Franklin, N. H.; John A. Burnham, Charles F. Choate, Uriel Crocker, Boston. The stockholders also elected Wyman Pattee, J. R. Brewer and Osmyn Brewster Auditing Committee.

Worcester & Shrewsbury.—At the annual meeting in Worcester, May 28, the following directors were chosen: Richard Barker, H. H. Bigelow, J. J. Coburn, James Draper, Walter Henry, Warren McFarland, E. B. Stoddard, David M. Wheeler, Worcester, Mass; George E. Hapgood, Shrewsbury, Mass. The board elected E. B. Stoddard, President; James Draper, Clerk and Treasurer; Richard Barker, Superintendent.

Troy & Greenfield.—This company still keeps up its organization, although the road has been for many years the property of the State of Massachusetts, and the stockholders met last week in Boston and elected the following directors; Henry L. Sabin, Williamstown, Mass.; Asa P. Morse, Francis L. Chapman, Cambridge, Mass.; Otis Clapp, Edward Appleton, Henry B. Rice, F. H. Forbes, D. W. Gooch, Boston; Gen. Herman Haupt, Philadelphia. The board elected Edward Appleton President.

Bristol Coal, Iron & Railroad Co.—At the annual meeting in Bristol, Va., May 24, Mr. H. C. Wood, of Estillville, Va., was chosen President, with the following directors: R. A. Ayres, E. V. Hilton, Patrick Hagan, W. W. James, W. A. Orr, E. P. Robinett, John F. Terrey, Ellington Wise, J. H. Wood.

Fort Dodge & Fort Ridgley.—This company has been reorganized with the following board of directors: George W. Bassett, Walter H. Brown, John F. Duncombe, W. M. Grant, Angus McBane, J. M. Mulrooney, George R. Pearsons, E. E. Prusia, C. B. Richards. The board has elected Walter H. Brown President; George R. Pearsons, Treasurer; James B. Williams, Secretary. The office is at Fort Dodge, Webster County, Iowa.

Chicago & Paducah.—The Illinois Circuit Court has appointed Mr. E. Ellery Receiver.

San Luis Obispo & Santa Maria Valley.—At the annual meeting recently the following directors were chosen: F. S. Wensinger, John Rosenfeld, George C. Perkins, C. Nelson, John O. Farrell, A. Blockman, John Henford.

Manchester & Lawrence.—At the annual meeting in Manchester, N. H., May 25, the following directors were chosen: Ezekiel A. Straw, B. F. Martin, Aretas Blood, Edward A. Abbott, J. W. Smith, Nathan Parker.

Junction & Breakwater.—Henry S. Marshall is appointed Auditor, with office at Lewes, Del., in place of Thomas McCoy.

Dakota Southern.—Mr. A. H. Morrison, of St. Joseph, Mich., has been elected Vice-President.

Illinois Central.—At the annual meeting in Chicago, May 30, the following directors were chosen: B. F. Ayer, W. K. Ackerman, James C. Clarke, Chicago; A. G. Dulman, Stuyvesant Fish, John Elliott, New York. Messrs. Dulman, Fish, Ayer and Ackerman are re-elected for the full term; Messrs. Clarke and Elliott are chosen to fill the unexpired terms of George Bliss and W. H. Osborn, resigned. Mr. Elliott is of the firm of Riggs & Co., of New York: Mr. Clarke was lately General Manager and is now Second Vice-President and has charge of the New Orleans, St. Louis & Chicago line.

Pacific Mail Steamship Co.—The new board has elected Wm. B. Clyde President; C. G. Francklyn, First Vice-President; Amos Rogers, Second Vice-President.

Petersburg.—Receiver Pegram has made the following appointments: Cashier, W. P. Taylor; General Superintendent, R. M. Sully; Train Dispatcher, L. E. Clark. The offices are at Petersburg, Va.

Pennsylvania.—Mr. John Reilly has been appointed Superintendent of Transportation. He formerly held the position, resigning when elected to Congress in 1874.

Ontario Southern.—Mr. Charles J. Pusey has been appointed General Freight and Ticket Agent, with office at Sodus Point, N. Y.

New Orleans, Jackson & Northern.—This company, successor to the New Orleans, Jackson & Great Northern, has been organized with the following officers: President, W. H. Osborn; Vice-President, James C. Clarke; Treasurer, R. S. Charles; Auditor, S. B. McConnico; General Freight and Passenger Agent, D. B. Morey. The offices are in New Orleans, La.

Vice-President Clarke announces the following appointments: Superintendent, W. P. McKinlay; Roadmaster Southern Division, J. J. Conway; Roadmaster Northern Division, J. A. Deaton. The office of General Manager is abolished.

St. Louis, Alton & Terre Haute.—At the annual meeting in St. Louis, June 4, the four directors whose terms then expired were re-elected, as follows: Anthony Thornton, Shelbyville, Ill.; G. W. Parker, Charleston, Ill.; M. M. Dill, Paris, Ill.; Levi Davis, Alton, Ill.

The board re-elected Robert Bayard, President; G. W. Parker, Vice-President and General Manager; E. F. Leonard, Secretary; H. T. Nash, Auditor.

Port Jervis & Monticello.—At the annual meeting in New York, June 4, the following directors were chosen: Henry Day, Frederick De Peyster, J. Ashton De Peyster, Robert E. Livingston, Adam Norrie, Gordon Norrie, William Alexander Smith, Benjamin L. Swan, Jr., James W. Hayward.

West Wisconsin.—The United States Circuit Court has appointed W. H. Ferry, late General Manager, Receiver of this road.

Portland, Saco & Portsmouth.—At the annual meeting in Kittery, Me., June 4, the following directors were chosen: Alfred P. Rockwell, S. L. Thorndike, W. H. Y. Hackett, Samuel Lawrence, George P. King, John B. Brown, George E. B. Jackson.

Syracuse, Phœnix & Oswego.—At the annual meeting in Syracuse, N. Y., recently the following directors were chosen: George G. Breed, A. P. Hart, H. T. Sweet, Williard Johnson, G. F. Comstock, A. A. Howlett, J. J. Glass, Thomas Gale, E. W. Leavenworth, Jacob S. Smith, Oliver Breed, S. O. Howard, C. B. Clark. The board elected the following officers: President, George G. Breed; Vice-President, Thomas Gale; Secretary, Patrick H. Agan; Treasurer, Alfred A. Howlett.

Fond du Lac & Lake Superior.—This new company was recently organized at Fond du Lac, Wis., with the following officers: Charles J. L. Meyer, President; Alexander McDonald, Vice-President; Senator Hiner, Secretary; A. G. Ruggles, Treasurer.

Cincinnati, Lafayette & Chicago.—Mr. H. W. Mead has been appointed General Freight Agent.

Chesapeake & Delaware Canal.—At the annual meeting in Philadelphia, June 4, Andrew C. Gray was re-elected President, with the following directors: George Cadwallader, Wm. Harmar, H. P. McKean, John F. Gilpin, Thomas A. Biddle, I. V. Williamson, Charles H. Hutchinson, Edwin Swift, David Scull, Mahlon P. Hutchison, John R. Baker, Charles Dutilh, Charles Norris, G. S. Benson.

Cairo & Vincennes.—Mr. Nicholas S. Pennington has been appointed General Freight Agent, in place of C. S. Sawyer. Mr. Pennington was formerly General Agent of the Cairo & Evansville Packet Line.

Newport & Maysville.—At the annual meeting in Newport, Ky., June 4, the following directors were chosen: Alfred Gaither, E. W. Woodward, W. H. Clements, C. W. West, J. H. Rhodes, Thomas D. Lovett, G. C. Goss.

Boston & New York Air Line.—At the annual meeting in Middletown, Conn., June 5, the following directors were chosen: Samuel S. Sands, D. B. Hatch, H. B. Hammond, Ripley Ropes, E. E. Anderson, T. L. Watson, H. G. Lewis, Isaac Anderson, J. N. Camp, G. S. Moulton, W. H. Hayward. The board elected E. E. Anderson President; T. L. Watson, Secretary; D. B. Hatch, Treasurer; H. B. Hammond, General Manager.

New York Central & Hudson River.—At the annual meeting in Albany June 6, the following directors were chosen: Wm. H. Vanderbilt, Wm. K. Vanderbilt, Cornelius Vanderbilt, Frederick W. Vanderbilt, Augustus Schell, Samuel F. Barger, Joseph Harker, Chauncey M. Depew, John E. Burrill, James H. Rutter, New York; George J. Whitney, Rochester, N. Y.; James M. Marvin, Saratoga Springs, N. Y.; Chester W. Chapin, Springfield, Mass. The new directors are Cornelius Vanderbilt the younger, F. W. Vanderbilt and General Freight Agent J. H. Rutter, who succeed Cornelius Vanderbilt, deceased, Henry R. Pierson and Walter S. Church.

PERSONAL.

—Hon. Peter B. Brigham, President of the Nashua, Acton & Boston, a director of the Fitchburg and other companies, whose death we noticed last week, was never married and left no direct heirs. Many years ago he made a will leaving the bulk of his large property to be used for the emancipation of slaves. Their general emancipation having rendered such a bequest useless, he made another will leaving some $3,000,000 to found a hospital for the sick poor. As already mentioned the greater part of his fortune was made while keeping a restaurant, and it is said that his great success was due to the fact that he never tried to make more than a fair profit out of his guests and to his unfailing politeness and attention to their wants.

—Mr. Horace F. Smith, General Freight Agent of the Memphis Line of the Louisville & Nashville, was drowned in the Mississippi River May 30. He was on the river with a companion and a boatman in a small skiff, when he suddenly exclaimed that he had burst a blood-vessel, and rising from his seat fell overboard and sunk before his companions could catch him.

—Gen. James Harding, one of the Board of Railroad Commissioners of Missouri, has undertaken the task of inspecting the railroads of the State by passing over them on foot. At latest accounts he had walked from Kansas City to Sedalia and was on his way to Moberly. How much time he intends to devote to the work is not stated, but he is said to average 25 miles a day.

—Mr. E. Collings, for several years Superintendent of the Wilmington & Northern (late the Wilmington & Reading) Railroad, and previously Superintendent of the Camden & Atlantic, died in Camden, N. J., May 29, of typhoid fever, after a lingering illness. He was about 40 years of age and leaves a family.

—Gen. John W. Sprague has resigned his position as General Superintendent and Land Commissioner of the Pacific Division, Northern Pacific Railroad, and will take the position of Manager of the Oregon Steam Navigation Company. General Sprague has represented the Northern Pacific on the Pacific Coast since 1870.

—Mr. H. L. Redhead, late President of the Canada Central and the Brockville & Ottawa companies, died in Brockville, Ont., June 4.

—Capt. N. Lott, President of the Corpus Christi, San Diego & Rio Grande Railway Company, was recently passing over his road beyond the terminus of the track with the agent of a Pennsylvania rolling mill, when a marauding party of Mexicans captured the two and robbed them of everything they had with them, even their clothing. A local paper says that Captain Lott had just been expatiating to his visitor on the magnificent resources of Texas and the generous hospitality of its people.

—The Pittsburgh *Commercial* says that Mr. S. M. Cumming, for 16 years past Master Mechanic of the Eastern Division, Pittsburgh, Fort Wayne & Chicago Railway, has resigned his position.

—Col. James H. Bowen, of Chicago, has filed a petition in bankruptcy, making George S. and Chauncy T. Bowen, his brothers, parties to the proceeding. George S. Bowen is Vice-President and Secretary of the Chicago & Pacific Railroad Company. The three brothers were formerly leading dry-goods merchants in Chicago, and were very wealthy.

TRAFFIC AND EARNINGS.

Railroad Earnings.

Earnings for various periods have been reported as follows:

	1876–77.	1875–76.	Inc. or Dec.		P. c.
Year ending March 31:					
Keokuk & Des Moines	$581,999	$741,339	Dec..	$159,340	21.5
Expenses	411,556	514,501	Dec..	102,945	20.0
Net earnings	$170,443	$226,838	Dec..	$56,395	24.9
Earnings per mile	3,615	4,605	Dec..	990	21.5
Per cent. of exps..	70.70	69.40	Inc ..	1.30	1.9
Five months ending May 31:	1877.	1876.			
Atchison, Topeka & Santa Fe	$844,347	$851,874	Dec..	$7,527	0.9
Chicago, Milwaukee & St. Paul	2,370,460	3,082,733	Dec..	712,273	23.1
St. Louis, Iron Mt. & Southern	1,664,718	1,466,744	Inc ..	197,974	13.5
Four months ending April 30:					
Atchison, Topeka & Santa Fe	$661,025	$639,791	Inc ..	$21,234	3.3
Net earnings	290,422	318,229	Dec..	27,807	8.7
Per cent. of exps..	56.06	50.26	Inc ..	5.80	11.5
St. Louis & Southeastern	328,452	313,929	Inc ..	14 513	4.6
Net earnings	62,319	38,281	Inc ..	24,038	62.8
Per cent. of exps..	81.14	87.79	Dec..	6.65	3.9
St. Paul & Sioux City.	129,472	162,041	Dec..	32,569	20 1
Sioux City & St. Paul.	73,970	102,987	Dec..	29,017	28.2
Union Pacific	3,782,247	3,289,634	Inc ..	492,613	15.0
Net earnings	2,170,737	1,536,093	Inc ..	634,644	41.3
Per cent. of exps..	42.61	53.30	Dec..	10 59	19.9
Month of April:					
St. Paul & Sioux City.	$38,269	$36,137	Inc ..	$2,132	5.9
Sioux City & St. Paul.	21,579	21,940	Dec..	361	1.6
Union Pacific	1,088,280	1,054,188	Inc ..	34,092	3.2
Month of May:					
Atchison, Topeka & Santa Fe	$183,322	$212,083	Dec..	$28,761	13.6
Chicago, Milwaukee & St. Paul	606,000	819,562	Dec..	213,562	26.1
St. Louis, Iron Mt. & Southern	304,000	257,339	Inc ..	46,661	18.1
Third week in May:					
Denver & Rio Grande	$14,294	.....	.....		....
St. Louis, Iron Mt. & Southern	84,600	$65,857	Inc ..	$18,743	28.4
Week ending May 25:					
Great Western, of Canada	$67,069	$77,696	Dec..	$10,627	13.7
Week ending May 26:					
Grand Trunk	$157,274	$163,885	Dec..	$6,611	4.0

Butter from Chicago to Liverpool.

Recently 500 packages shipped at Chicago by the Fort Wayne road and billed through to Liverpool reached their destination in 12 days and 6 hours. It is proposed to have refrigerator compartments provided on steamers for butter, something as are now used for fresh meat, and if this is done it is thought that a large export trade in this article may be developed.

Erie Canal.

The business of the Erie Canal at Buffalo from the opening to May 31 is reported as follows:

	1877.	1876.	Decrease.	P. c.
Boats cleared	628	700	72	10 3
Tolls received	$41,144 09	$90,074 33	$48,930 24	54.3

The canal opened May 8 in 1877 and May 4 in 1876. The tolls have been reduced this year.

Coal Movement.

Coal tonnages reported for the week ending May 26 were:

	1877.	1876.	Inc. or Dec.	P. c.
Anthracite	492,657	398,146	Inc ..	94,511	23.7
Semi-bituminous	64,899	76,610	Dec..	11,711	15.3
Bituminous, Pennsylvania	32,663	33,279	Dec..	616	1.8

At the auction sale of the Delaware, Lackawanna & Western last week the average price realized was $2.52 per ton; at that of the Pennsylvania Coal Company, $2.73 per ton. These are the lowest prices on record in New York, and certainly seem to be less than actual cost of production and transportation. It is reported that the other companies are forcing coal on the market at these prices to compel the Reading to join with them in limiting production. Meanwhile the tonnage brought forward every week shows a large increase. These extremely low prices for anthracite undoubtedly have an injurious effect on the semi-bituminous and Eastern bituminous trades, but they tend to increase the consumption of anthracite at towns and cities in the Northwest within easy reach of the lakes.

The anthracite coal tonnage of the Belvidere Division, Pennsylvania Railroad, for the five months ending June 2 was:

	1877.	1876.	Inc. or Dec.	P. c.
Coal Port, for shipment	9,153	76,231	Dec..	67,078	88.1
South Amboy, for shipment	276,409	185,839	Inc ..	90,570	48.7
Local distribution on New Jersey lines	74,171	59,178	Inc ..	14,993	25.3
Company's use on New Jersey lines	33,454	21,912	Inc ..	11,542	52.7
Total	393,187	343,160	Inc ..	50,027	14.6

Of the total this year 273,327 tons were from the Lehigh and 119,860 tons from the Wyoming Region.

Grain Movement.

For the week ending May 26 receipts and shipments of grain of all kinds have been, in bushels:

	1877.	1876.	Decrease.	P. c.
Lake ports' receipts	2,294,405	3,286,744	992,339	30.2
" " shipments	2,330,304	3,567,864	1,237,560	34.7
Atlantic ports' receipts	3,506,828	5,316,566	1,809,738	34.0

Of the shipments from Northwestern markets, 34 per cent. was by rail this year, against 51 per cent. in 1876, 36 in 1875 and 26 in 1874.

Buffalo grain receipts this year up to May 31 were as follows:

	By lake.		By rail.	
	1877.	1876.	1877.	1876.
Flour, barrels	78,435	62,666	454,900	432,000
Grain, bushels	6,227,704	6,511,621	5,770,340	5,324,800
Total, bushels	6,619,879	6,824,931	8,044,840	7,484,800

The total lake receipts this year show a decrease of 205,052 bushels, or 3 per cent.; the rail receipts an increase of 560,040 bushels, or 7.5 per cent.

Shipments eastward for the same period of grain received at Buffalo by lake were:

	1877.	1876.	Decrease.	P. c.
By canal, bushels	3,793,200	4,580,170	786,970	17.2
By rail	1.439,082	2,949,804	1,510,722	51.2
Total	5,232,282	7,529,974	2,297,692	30.5

The canal shipments were 72.5 per cent. of the total in 1877 and 60.8 per cent. in 1876. The canal opened May 8 in 1877 and May 4 in 1876.

Baltimore grain receipts for May were:

	1877.	1876.	Inc. or Dec.	P. c.
Flour, barrels	83,956	131,746	Dec..	47,790	36.3
Wheat, bushels	83,627	350,609	Dec..	266,982	76.3
Corn	2,724,122	2,537,740	Inc ..	186,382	7.3
Other grain	99,274	119,042	Dec..	19,769	16.6
Total, bushels	3,326,803	3,666,121	Dec..	339,318	9.3

For the five months ending May 31 the receipts were:

	1877.	1876.	Inc. or Dec.	P. c.
Flour, barrels	466,449	539,529	Dec.. 73,080	13.5
Grain, bushels	13,105,095	12,950,842	Inc .. 154,253	1.2
Total, bushels	15,437,340	15,648,487	Dec.. 211,147	1.3

Exports of flour for May were 32,475 barrels. The stock in elevator May 31 was 8,941 bushels wheat and 1,017,036 bushels corn.

Lake Vessel Grain Capacity.

Mr. Joseph Nicholson, of Detroit, sends to the Chicago *Inter-Ocean* the following list of lake vessels of different kinds, with their tonnage and grain capacity. Canada vessels are not included. Vessels of "canal size and under" are calculated at their canal capacity:

Class.	No.	T'l tons.	Bushels.
Steam vessels, 400 tons and upward	102	103,992	3,803,000
Steam vessels, canal size and under	56	20,136	835,000
Barges, 200 tons and upward	74	32 331	1,824,000
Sail vessels, 400 tons and upward	162	92,278	5,634,000
Canal vessels, 200 to 400 tons	313	89,231	5,028,000
Grand total	697	337,968	17,124,000

By this it would appear that the measured ton on the average is estimated sufficient to accommodate 50 bushels of wheat, though 37½ bushels weigh a ton of 2,240 lbs. But this varies in different classes of vessels; the larger steam vessels carry 37 bushels per ton; the small ones, 41 bushels; the barges, 57; the large sail vessels, 61; the smaller sailing craft, 56 bushels.

Mr. Nicholson urges this large vessel capacity as a reason for a combination of vessel-owners to prevent excessive competition for cargoes.

THE SCRAP HEAP.

Railroad Manufacturers.

F. Gardner & Co., at Carlisle, Pa., recently shipped 10 box, 8 gondola and 50 coal cars to a Canadian railroad.

The Bethlehem (Pa.) Iron Co. recently shipped 155 car-loads of steel rails in three days.

The Pennsylvania Iron Works, at Danville, Pa., are in full operation.

Stonewall Furnace, on the Selma, Rome & Dalton Railroad in Alabama, has stopped for repairs, but will go into blast again as soon as possible. Alabama Furnace, on the same road, has just started up.

Evans, Dalzell & Co., at Pittsburgh, have just completed an addition to their tube works. The building is 150 by 80 feet, and will be used as a finishing shop.

There is talk among Pennsylvania iron manufacturers of suspending work for a month. It is usual for the rolling mills to stop July 1 to take account of stock, and it is proposed to continue this stoppage for at least a month.

The Philadelphia correspondent of the *Iron Age* reports business in steel rails dull at present, with sales of only a few odd lots at $47 to $48 per ton at the mill. Plenty of buyers could be found for bonds or on long time, but sellers prefer cash. For iron rails, about the same situation is reported, with prices from $33 to $36 per ton at the mills.

The Pittsburgh *Manufacturer* says: "The Pennsylvania Steel Co., Harrisburg, have commenced the construction of three Whitwell hot-blast ovens, for their No. 2 furnace; size of ovens, 40 feet high by 18 feet diameter; furnace to be 75 feet high and 20 feet boshes. The work will be pushed forward with all speed."

The Patten Car Works at Bath, Me., have taken a contract to supply the European & North American road with trucks of 4 ft. 8½ in. gauge for all its cars, in preparation for the change in gauge of the road.

The buildings of the Pittsburgh Steel Casting Works were destroyed by fire on the night of June 1, the buildings being a total loss and the machinery badly damaged. The estimated loss is $75,000, one-third of which is on patterns.

The Ranlet Car Co., at Laconia, N. H., is building some cars of 24 in. gauge for the Bedford & Billerica Railroad in Massachusetts.

Tramps.

One tramp at least has met with a swift retribution. A telegram says that on June 3, as a tramp was standing on the New York Central track near Amsterdam, N. Y., amusing himself by stoning a passing express train, he was struck by a locomotive going in the opposite direction and instantly killed.

Enginemen and Firemen for Brasil.

A paragraph has been going the rounds of the newspapers to the effect that 19 locomotives were to be sent by the Baldwin Locomotive Works to Brazil about the 1st of June, and that an engineer and fireman were to be sent with each locomotive. Other circumstantial details were given in the same way. We are authorized to say that the whole thing is a complete fabrication, so far as sending any engineers, firemen or machinists to that country. The Baldwin Locomotive Works have no authority to send any men out of the country, and are not engaging any men for such a purpose.

Fireless Locomotives in Belgium.

The *Moniteur des Interets Materiels* of May 20 notes that trials were then being made in Brussels of a steam car in which "the steam is supplied by two boilers without fire. They contain water raised to a temperature of 200° by steam from a stationary boiler at the terminus." This car is patented in the name of the "General Tramway Company" and of Messrs. Bede & Co., and the one now running was constructed at the shops of the latter firm in Verviers.

Arkansas Excursion Trains.

Down in Arkansas it seems that the railroad men, unlike those in other States, take every opportunity to make something and are disposed to advertise as attractively as possible too. The St. Louis *Republican* says that an excursion train was advertised in Helena, Ark., lately, to the scene of a colored man's execution; and the bills said that a "good time was expected."

The Baldwin Steam Car in the Philadelphia Streets.

Mayor William S. Stokley, of Philadelphia, has addressed the following letter, dated May 26, to Messrs. Burnham, Parry, Williams & Co., proprietors of the Baldwin Locomotive Works:

"It affords me pleasure to express my favorable opinion of the use of steam upon our city passenger railways. I have carefully examined the workings of the Baldwin steam car now in use upon the Market street line, and my opinion is that it is superior to any ever tried in this city; and in the performance of work of ascending grades is admirable, and a great success. The only objection to the use of steam upon our highways ever made was the fear of our citizens lest frequent accidents should occur by reason thereof, but the recent experiment has proven that they can be run with as much safety as any other. I have heard of no complaints since your steam cars began service on the Market street line, but on the contrary have heard them commended in the strongest terms."

In forwarding this letter of Mayor Stokley, Messrs. Burnham, Parry, Williams & Co. write us:

"We may add that the steam car "Baldwin" completes today, June 4, the 76th day of continuous service since March 21. It has made 88 miles every day, Sundays not excepted, and has cost nothing for repairs. It has never failed on any grade, or left the track on a curve."

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Editorial Announcements.

Passes.—*All persons connected with this paper are forbidden to ask for passes under any circumstances, and we will be thankful to have any act of the kind reported to this office.*

Addresses.—*Business letters should be addressed and drafts made payable to* THE RAILROAD GAZETTE. *Communications for the attention of the Editors should be addressed* EDITOR RAILROAD GAZETTE.

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

THE SPRING GRAIN TRAFFIC.

The grain traffic this year is not so important as last, nor so interesting to study, for the reason, in the first place, that there is less grain to carry; and, in the second place, because there is no such competition of the railroads for the business as to make the course of shipments exceptional. Last year the traffic was unusually large—very nearly the largest on record—and moreover the railroads, before navigation had fairly opened, reduced their rates to a point rarely reached on the water route. It did not matter that this reduction was not made for the purpose of diverting the grain from the water route; it was sure to have that effect to a greater or less extent, and it was interesting to learn how far this great traffic could be diverted by rail rates doubtless something less than the bare cost of transportation—at least, on most of the roads which carried the grain. We therefore followed the course of the traffic closely from week to week. The result was that during the season of navigation, out of a total of 121,500,000 bushels shipped from the eight principal Northwestern markets, 54,000,000, or 44½ per cent. of the whole, were forwarded by rail.

This year the railroads have not renewed the contest which last year reduced their rates to the level of paying water rates. New grain business offered is charged one half more than the ordinary rate of last season. At the same time the failure of the wheat crops last year has left a comparatively small surplus to be shipped this spring. There is thus something like a return from the extraordinary circumstances of last year to the ordinary circumstances prevailing previously. The chief interest in the traffic under these circumstances is in tracing the effect of this return to the old policy.

In order to do this, we present the figures showing the number of bushels of grain of all kinds shipped from Northwestern ports by lake and by rail during each of the six weeks since navigation opened, with the percentage of the shipments by rail. We find from this that the totals for this period (April 15 to May 26) were :

	1877.	1876.	1875.	1874.
Lake shipments	8,488,927	10,222,098	7,443,324	14,735,725
Rail shipments	7,294,564	12,121,728	6,901,500	6,769,013
Total	15,783,491	22,343,826	14,344,824	21,504,738
Per cent by rail	46	54 1-4	48	31 1-2

In the totals moved, this year is similar to 1875, and 1876 to 1874. But in the proportions moved by rail, there is a great difference. In 1876 the lake vessels profited comparatively little by the great grain movement. They had but about two-thirds as much as in 1874, when the total shipments were similar, while the railroads had nearly twice as much as in that year. This year, with a return to something like the old system of charges, the railroads get very nearly the same proportion as in 1875; when the traffic was similarly light. However, and this is especially noteworthy, the rail shipments this year have been larger than for the same time in any preceding year except 1876—8 per cent. larger even than in 1874, when the total shipments for the six weeks were 40 per cent. greater than this year.

The share of rail shipments, however, apparently tends to decrease, as will be seen by the table, which is made up from the New York Produce Exchange reports, and has been published in another form (giving rail and grain shipments separately for each week for four years) from week to week in *The Public*, which is accustomed to make a most intelligent use of statistics.

Shipments of Grain by Lake and Rail from Northwestern Ports.

Week ending—	1877. By lake.	1877. By rail.	1877. P. c. by rail.	1876. By lake.	1876. By rail.	1876. P. c. by rail.
April 21..	387,001	1,881,480	83	1,251,193	1,616,449	56¼
" 28..	2,678,843	1,303,754	33¼	1,634,541	2,072,946	56
May 5..	1,343,677	1,341,677	29¾	2,445,191	2,292,633	48¼
" 12..	1,299,156	1,214,861	48	1,538,556	2,302,940	60
" 19..	1,244,288	758,450	38	1,606,209	2,016,304	55¾
" 26..	1,535,962	794,342	34	1,747,408	1,820,456	51
Total 6 weeks..	8,488,927	7,294,564	46½	10,222,098	12,121,728	54½
	1875.			1874.		
April 21..	159,537	1,119,558	87½	1,381,513	1,399,186	50¾
" 28..	230,561	1,616,449	87½	1,755,411	1,463,849	45½
May 5..	1,465,019	1,075,243	42¼	2,606,407	1,169,071	31
" 12..	2,243,139	1,236,079	35½	2,902,737	929,349	23¾
" 19..	1,565,842	850,929	35¼	3,260,930	850,929	20¾
" 26..	1,779,226	1,003,242	36	2,738,727	956,629	26
Total 6 weeks..	7,443,324	6,901,500	48	14,735,725	6,769,013	31½

Comparing the total shipments since navigation opened in 1876 and 1877, we find that there has been a decrease of 6,560,415 bushels, or nearly 30 per cent. Of this decrease, 1,733,171 bushels fell to the share of the vessels and 4,827,244 to that of the railroads. The vessels thus have lost business as well as the railroads, though not nearly so much. This was to be expected, for the vessels have no other traffic to depend upon, and of course will make all possible sacrifices in order to secure enough to keep them running. The result has been that before the close of May they were accepting 2½ and even 2 cents per bushel for carrying corn (not much else is moving) from Chicago to Buffalo, and now 2 cents is the ruling rate. In order to get this traffic—17 per cent. less than they had last year—they have had to accept considerably less than last year's rates, which were then declared to be ruinous. Since with the lowest rates the vessels have been unable to secure full employment, it is obvious that the tonnage afloat is greatly in excess of the present requirements of traffic. The railroads have taken a larger proportion of the traffic than in any previous year except 1876, but this proportion seems to be decreasing. The amount carried by them is 60 per cent. of their grain business during the corresponding six weeks in 1876; it is a tenth greater than in 1875, and 8 per cent. greater than in 1874. On the whole, we may say that the rail movement of this year is a return to something like the normal movement as indicated by the traffic of years preceding the excessive and abnormal movement of 1876, caused by accepting unprofitable rates. The railroads have no reason to complain of the amount of grain traffic which they have carried this season. If they had received their regular rates for all of it, it would have netted them several times as great profits as the traffic last year, which was nearly one-half greater if there were any profits on it last year). However, doubtless a large part of the grain this spring has been carried under contracts made a year ago at last year's rates. But for this it is not likely that the railroads would have held their own so well with the present 30 cent rate in the face of the extremely lower water rates.

So much as to the division of the grain between the rail and water routes. Last year special interest attached also to the distribution of shipments among the seaboard cities. The contest of the railroad companies was directed to this point, and this continues to be important, as a diversion of the grain trade from New York had begun on a large scale, and we need to know whether it continues, or how it is affected by the change in the policy of the companies by the recently agreed upon differences in rates to the various ports, and especially by the present large difference in rates in favor of the water route.

We have heretofore seen (*Railroad Gazette*, May 11, 1877, page 213,) that the changes during the winter as compared with the previous year were not very great, New York getting a somewhat smaller and Baltimore a somewhat larger share of the total sea-board receipts, but Philadelphia a considerably smaller and Boston a considerably larger share. Now if we examine the distribution of sea-board receipts for the six weeks since navigation opened, we will find a considerable change, as shown in the table below:

Distribution of Atlantic Grain Receipts before and after the Opening of Navigation.

	—Jan. 1 to Apr. 14.— Bushels.	P. c.	—Apr. 15 to May 26.— Bushels.	P. c.
New York	7,977,454	29.3	5,639,837	35.0
Boston	3,538,927	13.0	1,317,695	8.2
Portland	518,029	1.9	165,964	1.0
Montreal	82,000	0.3	739,059	4.6
Philadelphia	4,580,350	16.9	2,558,890	15.8
Baltimore	8,180,394	30.1	4,211,340	26.0
New Orleans	2,312,749	8.5	1,508,343	9.4
Total	27,189,903	100.0	16,141,128	100.0

Thus though Montreal entered the field, on which it makes no impression when navigation is closed, New York gained greatly in its proportion of the sea-board receipts, while Philadelphia lost a little and Baltimore a great deal.

Moreover, the tendency appears to be towards an increase in the proportion received at New York, though the latest reports do not show the effect of the recent reductions in lake and canal rates. This will be seen by the following:

Percentage of Total Seaboard Grain Receipts Arriving at Each Port for Six Weeks:

	Week Ending— April 21.	April 28.	May 5.	May 12.	May 19.	May 26.
New York	30.8	29.5	32.8	29.6	37.9	45.4
Boston	10.3	6.1	5.9	7.2	11.2	8.3
Portland	2.0	2.0	1.4	0.2	0.1	0.7
Montreal	...	0.8	1.3	9.8	5.8	7.9
Philadelphia	15.5	22.9	22.5	19.6	6.4	10.3
Baltimore	37.0	30.0	26.1	24.2	27.7	15.9
New Orleans	4.4	8.7	10.0	8.6	10.9	15.5

In the last column of the preceding table will be found the percentages for the entire six weeks. If we compare these with the percentages for the week ending May 26 a marked change is observable. During the first week of the six, New York and Boston received 41.1 per cent. of the total, and Philadelphia and Baltimore 52.5 per cent. During the last week, New York and Boston had 53.7 and Philadelphia and Baltimore only 26.2.

The loss of traffic is doubtless unsatisfactory to the Southern ports, but it is difficult to see how it can be prevented without carrying for very much less than cost. The grain has not been diverted by the New York railroads, but by the extremely low rates by lake and canal. The reductions by water have been such as to restore the difference in favor of the water route which the railroads had almost overcome while maintaining a paying rate, but did not quite destroy even last year, when they carried at a non-paying rate. Corn now is taken from Chicago to New York by way of the lakes and canal for about seven cents a bushel. Such of it as can easily reach the lakes is not likely, then, to go to Philadelphia or Baltimore, since even the ruinously low rail rate of last year was as much as 10 cents a bushel to these places. They cannot expect to get a very large share of the traffic except when it costs as little to send grain to Baltimore or Philadelphia as to New York, by whatever route—that is, except when navigation is closed, or when the water rate is nearly as high as the rail rate.

SCREW THREADS.

Notwithstanding all that has been written and said about the importance of having a uniform system of screw threads in railroad work, we seem almost as far as ever from reaching that desirable end. One reason for this is, that the people in authority on railroads seldom realize the great inconvenience attending the use of a diversity of screws and threads. If some of the superintendents, master mechanics and car-builders of our roads were compelled to lie on their backs on a wet day and twist and screw and hammer and swear in order to get a nut with twelve threads to an inch on a bolt with fourteen, or a nut with a screw ¾ in. in diameter on a bolt $\frac{1}{32}$ in. larger, it is probable that they would show more interest in the adoption of some common standard system.

Another reason why it is so difficult to have a standard system adopted is on account of the incorrigible ignorance of the whole subject on the part of master mechanics and master car-builders. During a recent journey among railroad men occasion was taken of the opportunity then afforded to bring the subject to the notice of those occupying such positions. Notwithstanding the fact that both the Master Mechanics' Association and that of the master car-builders had each a few years ago adopted, or rather recommended, the Franklin Institute system of screw threads as a standard, yet very few of the members know what that system is, excepting that it specified the number of threads to the inch for different sizes of screws.

It is obvious that a bolt and nut, if they fit each other, must in the first place have the same number of threads to an inch, and in the next be of the same diameter. That is, a bolt with a screw cut on it or in other words, a male screw, which is ¾ in. diameter over the outside of the threads, will not fit a nut or female screw which is $\frac{1}{32}$ larger. It is therefore important that the screws be of the same diameter. Now all good machinists know that in fitting a perfectly round bolt into a round hole almost the smallest conceivable amount of material—less in thickness than the thinnest paper—will make the difference between a good and bad fit. Now just the same condition of things exists with screws. If they vary in size the amount of a thousandth part of an inch that amount will make the difference between a good fit and a bad one. It is also known that if a bolt as nearly perfectly round as tools will enable us to make

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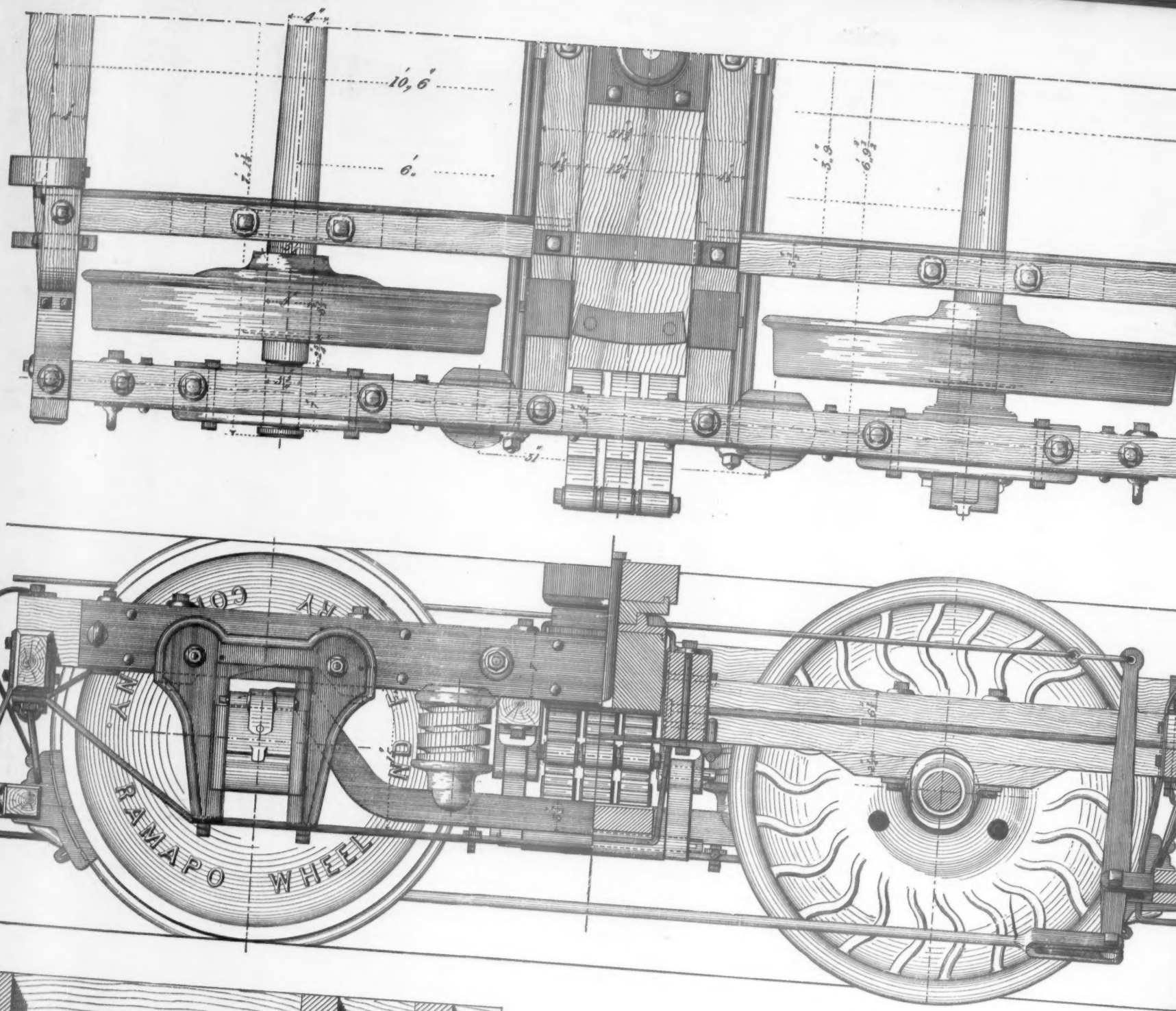
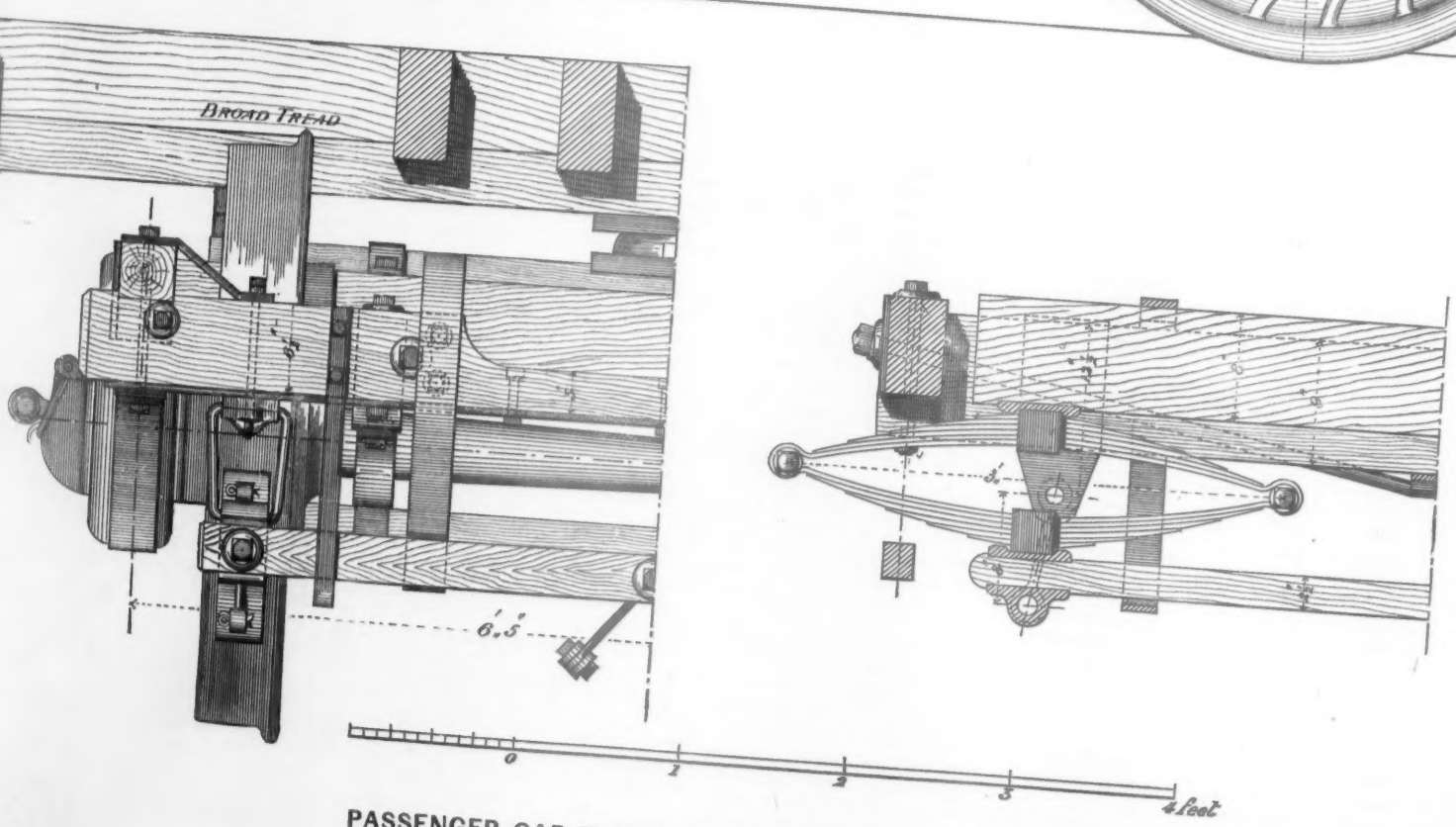
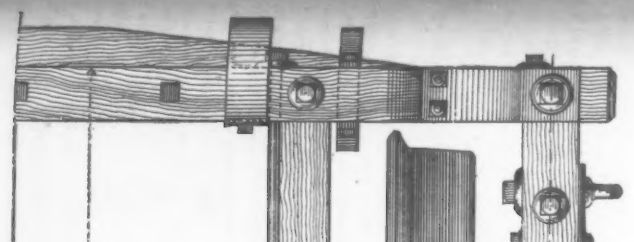




PASSENGER CAR TRUCK, ARRANGED FOR A 42-INCH WHEEL.

Designed by J. B. WHITE, Mechanical Engineer, for the Ramapo Wheel and Foundry Co., Ramapo, N. Y.



it, is fitted accurately into an equally perfect hole, there is very little liability of the one becoming loose in the other. Twenty-five years ago all car wheels were keyed to their axles to prevent their becoming loose; but it was found that with the accurate work which our modern tools enable us to do it is entirely safe to depend upon the fit *alone* of a wheel on its axle, if that is sufficiently accurate to bring the wheel hub into *uniform contact* with the axle over its whole surface. By uniform contact is meant that the pressure of the axle against the wheel is uniform over its whole surface. Car-builders also know how risky it is to trust to a car wheel in which the axle is made to fit by picking the surface of the latter with a centre punch. In that case the surface of the axle is in contact with the hub of the wheel only at those points or projections produced by the punch, and is therefore liable to work loose. Now it is equally important that the whole surface of the thread of a screw should be in *uniform contact* with that of the thread in the nut, in order that the one may not work loose on the other. This is especially the case if the bolts and nuts are subjected to constant and violent jars, as they are on railroad cars and engines. In order that there may be this *uniform contact*, the threads must be of the same form on the bolt and in the nut. An ordinary thread on a bolt consists of a spiral V-shaped groove cut in its surface, and the thread in a nut is a spiral V-shaped projection on the inside of the nut which fits into the groove on the bolt. It is plain that if the angle at which the sides of the V-shaped groove stand to each other is not the same as that of the sides of the projection in the nut which fits into the groove, then the one cannot be in uniform contact with the other. If, too, the point of the projection in the nut is left sharp and the groove in the bolt is either rounded or made flat, then the thread of the nut will not fit the groove in the bolt. In other words, it is obvious that the form of the thread in the nut must be an exact counterpart of that in the bolt, and that the *form* of the threads is a very important element in securing uniform contact and good workmanship.

Now all this was realized a good while ago, and in 1864 the Franklin Institute in Philadelphia appointed a committee to report upon the subject. This committee reported and recommended the system of screw threads devised by Mr. William Sellers. The report of this committee was adopted. Afterwards the Army and Navy departments of the United States recommended the adoption of the same standard, and the Master Mechanics' and Master Car Builders' associations followed, so that the system has the authority which such action can give. Now the Sellers or Franklin Institute system designates, first, the diameter of the bolt; second, the number of threads to an inch; and, third, the *form* of the threads.

Now what is remarkable is, that so few of those in charge of the machinery of railroads know that this standard, which their own associations have recommended, does more than specify the number of threads to an inch for different sizes of bolts. The ignorance on this subject is quite inexcusable. It has been presented over and over again in newspapers, in books, and discussed at annual conventions. Several prominent firms are manufacturing tools and gauges for making the taps and dies with this system of threads, and other firms are now making the taps and dies themselves, and selling them it is believed for much less than it will cost railroad companies to make them in their own shops.

Quite recently, in a discussion of this subject with a master mechanic of a prominent road, he was asked what system of screw threads he was using. "Oh," he said, "I am using the United States standard." When asked if he was certain that it was correct: "Oh, yes," he said, "I ordered the taps and dies from ——," naming a prominent house, "and specified that they were to be of the United States standard." On going through the shop he showed the taps and dies, and some of the screws cut by them, and it was found that they all had threads which were sharp at the top and bottom, and also that he was not aware that the Franklin Institute standard, which is the one which has been recommended by the associations named, has a thread which is *flat* at the top and bottom.

It is unfortunate that the term United States standard has been used, because it has been applied to several different systems; therefore master mechanics and car builders are advised always to be suspicious of taps and dies which are said to be the United States standard. In ordering them, designate what you want as the Franklin Institute standard, and there will be no mistaking your meaning.

In many cases it was found that railroad companies have adopted systems of their own, and very great objection was made to using any other. It would of course be practically impossible to remove all old bolts and replace them with new ones having the standard system of threads, but uniformity could be brought about gradually, if in ordering new engines or cars it should be specified distinctly that the Franklin Institute screw threads should be used, and then some little care exercised to be sure that the specifications were followed. In this way it would gradually come to be recognized, with very little confusion, that the new rolling stock had the Franklin Institute standard threads.

The longer this reform is delayed, the more difficult will it be to bring it about. It is believed that the chief reason why this standard has not been generally adopted heretofore is because of the inexcusable ignorance of the subject on the part of those who ought to have known about it.

Some standard system of screw threads is more important in the construction of cars than for locomotives, because the latter are always repaired at home, whereas cars go everywhere.

The Passenger Troubles.

The passenger war which had threatened so long has at last broken out. Saturday last the Lake Shore Company reduced the rate from Chicago to New York to $15 for limited tickets, in which action it was followed by the other roads. This step was bad for the railroads, but it gave their passengers what they lost, and we may be sure that there was no popular dissatisfaction at the step; but when the fare by the Fort Wayne road had been reduced to meet the rate by the Michigan Central and the Lake Shore, the latter roads took steps to put themselves on an equality with their rival by meeting its time, and Tuesday it was announced that each of these roads would put on a fast train, beginning next Saturday, which will leave Chicago at 1:30 p. m. and reach New York at 7 p. m. the next evening, thus making the trip in 28 hours and 35 minutes true time, which is at the rate of 34 miles per hour by the longer route. It is not, however, a particularly advantageous train for passengers to take. They lose half a day in Chicago to gain an evening and a night in New York: that is, passengers by the regular Atlantic express leaving Chicago at 5:15 p. m. get to New York early on the second morning, about twelve hours later than those who take the proposed 1:30 p. m. train. But probably not much heed is had to the accommodation of passengers. They never have been much attracted by the fast Chicago-New York trains that have run heretofore, and they are not likely to be more so now. When towns are two nights and a day apart, the traveler does not save much effective time—time that he can use—by any practicable shortening of the time. At best, it gives him a bed in a hotel in place of a berth in a sleeping car, and oftener it spoils a part of a second day for him in order to do this. But we may say that the object of these fast trains is not to bring about a condition of affairs as agreeable as possible to travelers, but one as disagreeable as possible to the railroad companies. They are first made to lose money which the public gets by a reduction of fares, and then to lose more money which nobody gets by an increase of expenses to secure a speed which nobody wants. This seems very wasteful, but this is what a railroad war is for. Like some other contests, it consists in inflicting injuries, and that party is most skillful who hurts his opponent most, provided that he does not inflict an equal injury upon himself. But there lies the great difficulty in the tactics of a railroad war. The stroke which cuts off a head in the enemy's army is likely at the same time to cut off one—perhaps two—in our own force. Reducing the fare to $15 from Chicago to New York means a reduction in profits to the Pennsylvania Railroad of $200 per through train, perhaps, but then it means the same thing to the other lines which make the reduction. The one with the largest business suffers most; but the one with the longest purse and the fewest demands on it holds out longest—much as the case is with nations.

So far, the war seems to be very mildly conducted. The reduction in rates does not extend to travel westward. You can ride from Chicago to New York for $15, but you must pay $20 to go from New York to Chicago. There is exhibited none of that fierce appetite for the fray which sometimes characterizes such contests. The impression conveyed is that everybody believes the whole thing to be a bad job, and is really anxious to back down gracefully, while pretending, perhaps, to breathe forth threatenings and slaughter. This, however, will not prevent a continuance of the contest and even its aggravation, but it makes an early peace more probable.

As often happens, there seems to be not the least tendency to discord regarding freight business, notwithstanding the conflict over passengers. The antagonists are laying out savagely at each other with their left hands, it is true, but at the same time their right hands are clasped in friendship. The managers take counsel together as to the best method of promoting the common good in the conduct of one part of their business, while they plot separately to destroy the value of another part of their business.

Is has been said that the reduction in passenger rates is unimportant after all, because there is not much business. It is true that business is light, but that does not prevent the loss of a profit of five dollars per passenger between Chicago and New York from being regrettable. It is more so this year than usual, probably, for this year low rates have very little effect in stimulating traffic. It probably includes the entire profit on this business. It is, however, easy to exaggerate the loss. Chicago is the most important interior point for passengers as well as freight, doubtless; but, after all, Chicago passengers are but a fraction of the whole number, and so far rates to points east of Chicago are not reduced as much as Chicago rates, and probably will not be; and so far, we see, only half of the Chicago business is affected—that from Chicago to the East, and not that from the East to Chicago.

The Proposed Trunk Line Pool.

The trunk line pool has not been abandoned, though very little has been said of it of late. The details are not yet all agreed upon, and the present trouble concerning passenger business causes more doubt than would otherwise exist as to the final execution of the scheme; though as yet no disagreement has occurred which is regarded as difficult to settle. At one time it was intended to include the whole petroleum traffic in the pool—or rather in a pool to be formed by the same parties and at the same time; but that was given up, the peculiar and exceptional condition of that traffic doubless making it especially difficult to agree as to the proper share due to each line. The plan at present contemplates only the pooling of freight from New York westward over the trunk lines to competitive points. As we have said before, it is a great point gained that the managers of the four trunk lines are finally satisfied that a combination can be made which will be advantageous to them all. If this conviction is once firmly established, then a combination of some kind is pretty sure to follow sooner or later. However, it is idle to conceal the fact that there are considerable obstacles in the way of such a step, and that more will be put in the way if the scheme once assumes tangible form, and also after it has gone into effect; and probably the largest part of this opposition will come from employes of the railroad companies themselves, active, intelligent, and very influential men, who get well paid for doing a work necessary under the present system, but which would be abolished almost entirely if the business was pooled. The combination which would save half a million to the companies would cause the loss of their offices and emoluments, and they will not lose them without a struggle. And they can do a great deal to make any scheme fail, if they choose. It is popularly supposed that the President and directors and other managers of a company make the policy of a railroad; but these officers begin to suspect that their policy is pretty generally made for them by sundry of their employes, and that any scheme for avoiding an expenditure of money is pretty sure to be proved "impracticable" by the people on whom it is expended. It is as if the declaring of war and the maintenance of peace were made to depend on the will of contractors for army supplies.

There are possibilities in such a combination of so increasing the accommodations given to the public and insuring stability and equity in rates that a few months' experience of it could secure the general favor of shippers, who at present are liable to have their business seriously affected or even destroyed by the iniquitous special "time contracts" which are almost always made when there is a railroad war. No such combination will be satistactory unless effort is made to secure all the advantages which it makes possible—advantages for the public as well as for the carriers—and the companies would do well to aim at some of the former, even if at first they fail of some of the latter.

Forty-two Inch Car-Wheel Truck.

There has been a great deal of discussion recently about the diameter of car-wheels, and the idea that the wheels now generally used are smaller than they should be has gained ground very rapidly among many railroad men. For these reasons our readers will be interested with the engravings of a truck designed for 42 in. wheels and published herewith. The arguments used in favor of 42 in. as against 33 in. wheels are, first, that the former make fewer revolutions in running a given distance, and therefore cause less axle friction. Second, a large wheel will surmount an obstacle or inequality on the track with greater ease than a small one. Not only will less power be required to roll the large wheel over an obstacle, but the jolt produced thereby will be less violent and the motion of the vehicle will consequently be easier than if mounted on small wheels. Third, large wheels have a greater effective bearing area on the rails than smaller ones, and consequently the wear both to the wheels and to the rails will be less with the former than with the latter.

It is true that a stronger axle is required with a large wheel than with a small one, but the strain due to the increased diameter of wheel is exerted on the axle chiefly at the inside of the hub of the wheel, and there is no reason for believing that any increase in the diameter of the journals is needed if the diameter of the wheels is increased. Thus with a 33 in. wheel and the master car-builders' standard axle, the proportions of the diameter of the wheel to the axle is as 5 to 44; with a 42 in. wheel it is as 5 to 56. The motion of the rubbing surfaces is therefore less in the one case than in the other, and at the same time the journal will make fewer revolutions with the large wheel than with the smaller ones in running a given distance.

The master car builders' standard axle is, it is believed, large

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enough for 42 in. wheels and would give as great security as the present axles in general use now give with 33 in. wheels.

The Ramapo Wheel and Foundry Company has given special attention to the manufacture of these large wheels, and the truck which we illustrate was designed for that company.

It would be a serious obstacle to the introduction of 42 in. wheels if it were necessary to use the car bodies and the draw-heads in order to raise them; and the chief effort of the designer of the truck illustrated has been to avoid such necessity. To do this he has lowered the bolsters, and cut out the wheel piece as shown by the dotted lines. The wheel piece is then strengthened by attaching an iron plate $\frac{7}{8}$ or $\frac{5}{8}$ in. by 7 in., as shown by the engraving. In this way the full strength of the truck is preserved, while the car-body and draw-head are of the same height as at present with 33 in. wheels.

Statements more at length of the advantages of large wheels were made in the *Railroad Gazette* of March 2 (page 96), 1877; in a letter from Mr. Herbert Wallis, Mechanical Superintendent of the Grand Trunk Railway, and in the same number (page 101) in a paper by Mr. W. W. Snow, of the Ramapo Works, read at the February meeting of the Master Car-Builders' Association.

The Ramapo Company first supplied these wheels to the Pullman Palace Car Company about a year ago and now they are in use on the Grand Trunk, the Lake Shore & Michigan Southern, the Flint & Pere Marquette, the Atchison, Topeka & Santa Fe, the Boston & Providence and the Boston & Albany railroads, while they have been ordered by the Maine Central and other lines are preparing to introduce them. Thus far the results are reported to be entirely satisfactory.

Coal Freights in England.

The following are given as the rates charged during seven years by the line formed of the Manchester, Sheffield & Lincolnshire and the Great Northern Railway from the mines in South Yorkshire to London, a distance of 170 miles, per ton of 2,240 lbs.:

September, 1870, to November, 1870	$1.98
November, " to December, "	1.76
Jan. 10, 1871, to Jan. 15, 1871	1.60
Jan. 16, " to March 9, 1871	1.44
March 10, 1871, to March 31, 1871	1.27½
April, 1871, to June, 1871	1.20
July, 1871, to October	1.45
November, 1871, to January, 1872	1.60
March, 1872, to June, 1872	1.70
August, 1872, to September, 1872	1.88
July, 1875, to December, 1875	2.00
January, 1876, to March 10, 1877	2.12½
Since March 10, 1877	2.00

The current rate is thus 1.18 cent per long ton per mile, equivalent to 1.05 cent per ton of 2,000 lbs. The lowest rate of the period was 0.70 cent per long ton per mile. The rate is made up of four parts: the charge of the Manchester, Sheffield & Lincolnshire Railway from the mine to Doncaster, less than ten miles, the charge of the Great Northern for the chief part of the haul (at a lower rate than that of the other roads), a shilling per ton for use of car (the shipper may supply his own cars), and a shilling for the London terminal charge.

The anthracite coal roads in this country do not often receive as little as these rates, even the highest of them; but many other roads carry all their freight—merchandise as well as minerals—at an average rate as low as the current coal rate on the Great Northern. Thus the Lake Shore in 1876 received 0.817 cent; the Pittsburgh, Cincinnati & St. Louis, 0.88 cent; the Columbus, Chicago & Indiana Central, 0.85 cent; the Pennsylvania main line and branches, 0.892 cent; the New York Central & Hudson River 1.05 cents; the Erie, 1.099 cents.

It is not often that any statement of English freight rates is made, and this is therefore the more interesting. We have never seen any statement of the *average* receipt per ton per mile of any English railroad. Merchandise freights there are not strictly comparable with our general freights, as English freight trains make fast time, and the "goods" service is almost equivalent in speed to our express service; but mineral trains afford just about the same service there as coal trains do here.

Petroleum Traffic.

Petroleum traffic is now in a peculiar condition. There is more of it than ever before, the exports for the past five months showing an enormous increase over those for the corresponding period of any previous year (30 per cent. more than in 1876, when they were larger than ever before). But the business is very differently divided. Baltimore and Philadelphia are losing business largely in spite of the great increase in the total movement. They have exported but 29 per cent. of the total this year against 45 per cent. last; while New York has increased its proportion from 52⅕ to 71 per cent., and its quantity from 42,000,000 to 74,500,000—the New York exports alone being nearly as great as the total exports of last year. Even this does not show the whole extent of the diversion of the oil traffic from one railroad to another, for the Philadelphia receipts, formerly exclusively, or practically so, by the Pennsylvania Railroad, now arrive chiefly by the Erie & Lehigh Valley route, we understand, which last year had none of this business. The change, however, is said to be due chiefly to a quarrel between the chief shippers and the Pennsylvania Railroad and the Empire Line which works over that road and has heretofore been one of the chief carriers of oil to Baltimore and New York as well as Philadelphia. This company, it is said, in connection with other parties has been preparing to establish great refineries in Philadelphia, with the intention of making it the great refining centre of the country—to make an establishment which should supplant the Standard Oil Company of Cleveland as the great power in the petroleum trade. This brought about the opposition of the other established refiners, including the Standard Oil Company, which has been manifested by their refusing to ship by the Empire Line or the Pennsylvania Railroad. This has enormously increased the oil traffic of the Erie and the New York Central, but it is intimated that the business is not as profitable as it used to be. It has been profitable usually when all or nearly all other through business was carried at unprofitable rates, and has made a very appreciable addition to the net earnings of the several roads, and especially of the three northern lines, the Baltimore & Ohio having but recently fairly got access to the oil regions.

Record of New Railroad Construction.

This number of the *Railroad Gazette* has information of the laying of track on new railroads as follows:

Burlington & Lamoille.—The first track is laid, from Burlington, Vt., to Jericho, 13 miles.

Pensacola & Mobile.—Track laid from Pensacola, Fla., to Muscogee Mills, 16 miles.

Longview & Sabine Valley.—The first track is laid from Longview, Tex., south 4 miles. It is of 3 ft. gauge.

East & West Texas.—The first track is laid from Houston, Tex., north by east 20 miles. It is of 3 ft. gauge.

Southern Pacific.—Extended from Pilot Knob, Cal., to Yuma Crossing, 4 miles.

Central Pacific.—On the *Loop Line* from Oakland to Bantas, track is laid from Bantas, Cal., north by west 10 miles.

North Pacific Coast.—Extended from Moscow, Cal., to Duncan's Mill, 1 mile. It is of 3 ft. gauge.

This is a total of 68 miles of new railroad, making 461 miles completed in the United States in 1877, against 552 miles reported for the corresponding period in 1876, 278 in 1875, 509 in 1874, and 1,083 in 1873.

Railroad Conventions.

Annual conventions of railroad associations will be held as follows:

The Master Car-Builders' Association, at Cleveland, Wednesday, June 13.

The Railroad Purchasing Agents' Association of the United States and Canada will hold its fourth annual meeting at the Kennard House in Cleveland, O., June 19 and 20, 1877.

A number of subjects have been named for discussion; a full attendance is looked for, and the meeting will be interesting and profitable to all who will attend.

The present officers of the Association are: Col. J. F. Sterling, President; A. C. Armstrong and Allan Bourn, Vice-Presidents, and A. G. Thompson, Secretary and Treasurer.

ERIE CANAL TRAFFIC cannot be said to be satisfactory either to the boatmen or to the State as proprietor of the canal and collector of tolls for its use. The tolls were reduced one-half to give the boatmen a chance to make something and to increase the volume of traffic. But the returns of canal business for May show that 3,743,000 bushels of grain this year against 4,580,000 last; and the average rate received by the boatmen was about 5¼ cents a bushel for wheat and 4¼ for corn this year, against 6.7 for wheat and 5.8 for corn last year—a decrease which the reduction of a cent a bushel in tolls does not make good. The proportions of the canal provision traffic are shown by the report to have been 913 barrels of pork and 1,335,085 lbs. of lard in May—altogether equivalent to 77 carloads, which at regular rail rates would have added $6,930 to the gross income of the trunk lines. The tolls, of course, are still more unsatisfactory than the traffic: they fell from $90,074 in 1876 to $41,144 this year. At this rate the State will not have money enough to open the canals next season.

THE LAKE VESSEL GRAIN CAPACITY has been footed up and found to be equal to the accommodation of 17,124,000 bushels of wheat at a single load. Last season the whole number of bushels of grain of all kinds carried by lake vessels was 67,500,000 bushels; so that, apparently four trips of the entire fleet would have done the work. As there is a much smaller amount to carry this year, and no more demand for tonnage for other traffic, apparently the vessels will be able to take a long holiday this year without injury to anyone.

OUT WEST.

III.

ST. LOUIS.

One of the most difficult things which a correspondent is called upon to do is after a short visit to give a brief description of a large establishment like the works of the

VULCAN IRON COMPANY.

To set down merely what he sees and hears, would only be a record of phenomena, and would not convey any adequate idea of the purposes for which such an establishment has been organized and constructed, or of the means employed for accomplishing its ends. To do anything else is extremely difficult, excepting to a person thoroughly conversant with the science, art and practice of iron and steel manufacture, and who would therefore see at a glance the cause and effect of everything he saw. Having neither the knowledge to be able to perceive, nor the time to investigate thoroughly, these few notes of the works of the Vulcan Iron Company, which are located at Carondolet, a few miles beyond St. Louis, must necessarily be very superficial.

This establishment, it may be stated, is not only intended to manufacture iron, but besides three blast furnaces it has now a very complete equipment of "plant" for the production of Bessemer steel and its manufacture into rails. It is a stock company in which Commodore C. K. Garrison, of New York; Mr. Oliver Garrison, Mr. D. K. Garrison and Messrs. Chouteau, Harrison & Valle, of St. Louis, are the largest owners. In 1868 the works were commenced by the building of two blast furnaces, and in 1869 these were put in blast with the intention of manufacturing iron rails, and in the same year the company began the erection of a rail mill. It was then found that the iron produced was not suited for that purpose, but as some was supplied to steel works it was found to be admirably adapted for the manufacture of Bessemer steel, which suggested the idea of the erection of the necessary plant for the manufacture of such steel, which idea was carried out, and the steel works were begun in July, 1875, and finished about a year thereafter. The establishment now has three blast furnaces, and two seven-ton Bessemer converters, with rolls and all the other machinery for the manufacture of steel rails.

The ores used are chiefly from Iron Mountain, with red hematite from Southwestern Missouri on the line of the St. Louis & San Francisco Railway.

The works as they now stand are among the largest and best equipped in the country, and their location so near to the great ore beds, or rather ore mountains, of Missouri is very favorable both for cheap production and for delivering to the railroads of the West and South. At present the works are running chiefly on orders for the Union Pacific, Central Pacific, Missouri Pacific and the New Orleans, Mobile & Texas roads.

WESTERN IRON BOAT-BUILDING COMPANY.

The works of this company are near to those of the Vulcan Iron Company. They were established for the purpose of building iron boats for the Western rivers, and have quite recently taken up the construction of iron railroad cars as a branch of their business. At the time of the visit of the Master Mechanics' Association to the Vulcan Iron Works, two iron platform cars were shown which were built by this company, and had been in service on the Iron Mountain road for several months. These have given very good results, but since they were designed the Superintendent, Mr. Theodore Allen, has made some modifications with a view of reducing their cost. The latter is the chief obstacle in the way of their introduction, but it is thought that the increased service and the diminution of the cost of repairs will ultimately much more than offset the increased first cost. On the Baltimore & Ohio Railroad iron coal cars have now been in use for more than twenty years. It has been found there that the cost of their repairs is considerably less than that of wooden cars. The case might, therefore, be presented as follows: If iron cars were more economical than wooden ones twenty years ago, when wood was cheap and iron dear, it would seem that the argument in their favor is now much stronger, when iron is cheap and wood dear. At any rate, the Western Iron Boat-Building Company is prepared to build iron cars and by furnishing them to railroad companies to show practically whether or not they are more economical than wooden ones.

BLOOMINGTON.

Probably no railroad line in this or any other country is provided with better car service than the Chicago & Alton Railroad. It was on this line that Mr. Pullman first developed his system of cars, and each successive improvement has been applied here first, and then permanently added to the equipment of this line. There are, however, some discomforts and annoyances attending travel in sleeping cars that even the genius of Mr. Pullman has not been able to overcome. He has thus far not succeeded in infusing a spirit of gentleness into the demeanor of the offensive and aggressive class of travelers who make themselves obnoxious in every car and hotel in the land, by their disagreeable familiarity, brazen impertinence, boisterous manners, their decayed and odious jokes, and whose conduct and conversation has the stupidity of coarseness and the coarseness of stupidity. And yet this same class of people would probably fight—if not too cowardly—if it was intimated that they were not gentlemen. Mr. Pullman has changed long railroad journeys so that instead of being periods of prolonged weariness they have become occasions when the traveler's time is spent in luxurious ease. Now if in addition to this, he could so modify the habits and manners of the Philistines who travel, so that intercourse with them, instead of being, as it now is, frequent cause of offense, would be a source of agreeable entertainment, then travel would be divested of one of its chiefest annoyances. Precisely how Mr. Pullman could do this is, however, left to his own genius to determine. He might scatter a few "behavior books" and several volumes of Chesterfield's letters through his cars for the perusal of its occupants, or he might prepare rules and regulations such as these: "Passengers are requested not to swear in the presence of others without first asking the permission of the latter; not to pick their teeth when any one else is in sight; not to clear the nasal passages without the use of a handkerchief, nor their throats audibly; not to manifest any curiosity regarding their fellow-passengers' destination, business, family relations or other affairs; and in order to show that they have not themselves once been servants, or, if they have, in order to conceal it, to treat those who are respectfully; ladies not to cause innocent bachelors to blush by disrobing within sight of the latter." (N. B. This regulation is by no means unnecessary in sleeping cars.)

These rules are given only by way of suggestion. Mr. Pullman's genius would of course suggest many additions and modifications, and doubtless should he undertake to frame a code of deportment, it would go down to posterity as one of the indisputable evidences of what this age is not.

One other suggestion is made for his consideration: It is popularly believed that his sleeping cars are sources of illimitable income, so, of course, no amount of money should stand in his way in bringing about any needed reform. In order therefore to call in the aid of the greatest amount of talent, it is *demanded*, on the part of much-suffering humanity, that he offer a premium of $999,999.99 for a device to prevent his passengers from snoring. It would be money well spent and the long suffering public would be grateful therefor: that is, for spending the money.

However, joking aside, one of the features of sleeping cars is that in them human nature appears in some of its most disagreeable moods. Nearly all persons are more or less ill-humored, either just before sleeping or just after waking. Ordinarily when in this condition they are separated from the rest of the world in the sanctity of their own rooms; but in

sleeping cars such ill-nature is apparent to all their fellow-passengers.

Bloomington, Ill., is about half way between Chicago and St. Louis, and as the through trains leave each of these places in the morning and the evening, they reach Bloomington about two o'clock of the day or night. It is, therefore, necessary either to spend twenty-four hours there, or else either to arrive or leave at a very uncomfortable hour of the night.

The only attraction to a railroad man in Bloomington is the railroad shops. These, as most of our readers know, are quite extensive and well equipped, but are now worked on short time and with a very limited force. The cause is the same that exists everywhere else. Both the Master Mechanic, Mr. Jackman, and the Master Car Builder, Mr. Reniff, are doing nothing more than to keep up repairs and do it at the least expense. There was not time to do more than to take a hasty look through the shops nor to make any observations worth recording. It may perhaps be said of shops as of nations, that those which have the least history are the best governed. Everything at Bloomington seemed to be going on so smoothly and regularly that the writer's condition is analogous to that of the young man gazing rapturously into the face of his beloved, who, when requested to make a remark, said he had been trying to think of something but couldn't, but was content with looking only.

CHICAGO.

Only a dictionary would supply adjectives adequate to describe Chicago, the wonderful; but perhaps to one who knew it best before the excessive "hot spell" from which it suffered a few years ago, the most striking thing at first is its overgrownness. Here as everywhere else after great fires, the buildings erected in the place of those destroyed accommodate many more persons than did those which were burned. The new ones are, as a rule, larger, better designed and are built with more stories and much more room. The same thing occurred after the Portland fire, and also in Boston. In Chicago, too, the panic of 1873 following two years after the fire, checked the former rapid increase in the business of the city, so that less room was needed than was naturally expected. This fact, taken in connection with the other, has left the city with more buildings and rooms than there is any demand for, and at every turn the significant sign "To Let" meets one's eye. "Rooms to Let" is especially frequent, and house after house on the principal business streets, like Clark and State streets and Wabash avenue, bears that somewhat—in Chicago—"strange device." Rents, especially of places of business, report says, are down far below any degree of lowness ever before known here, and real estate is not worth half what it was before 1873.

A stranger is struck, too, by the magnificence of much of the rebuilt part of the city. While the scars and blanks left by the great fire are still very common, yet the business part is almost entirely covered by great buildings not equalled in size anywhere in the country. This, too, is true not only in a few exceptional cases, but it is the rule almost of all the new buildings intended for business. In the design of these the architects apparently adhered to the old traditions, or rather to the precedents and practice of their brethren in this country. In Boston the young school of architecture, at least young to this country, has had a much greater share in designing the rebuilt part of the city. In Chicago the designs are generally of the Renaissance school, whereas in Boston they are, very many of them, Gothic, designed by the disciples of Ruskin, or believers in the principles which he inculcated. In Chicago a stranger is impressed by the size, extent and cost of its buildings; in Boston much more by the exquisite taste shown by the builders. The hotels in Chicago are a very noteworthy feature. Since the fire these have multiplied to a remarkable degree. Besides the larger ones, such as the Grand Pacific and Palmer House, there are a score of others, all of them good-sized houses, and many of them well kept. One who knew Chicago only before the fire finds new hotels in almost every block, and it is said that at the present time over 10,000 people can be *comfortably* lodged and fed in the hotels alone, and many more in the lodging houses of various kinds scattered in every direction. The Grand Pacific alone has 500 rooms for lodging guests, and the Palmer House a still larger number, and the Sherman and Tremont houses from 250 to 300 each. The Grand Pacific is 750 × 400 feet and 130 feet high. The hotel business is some indication of the amount of travel which passes through and centres here. It was thought that the hotel capacity of Chicago would be very much greater than would be required, and yet the very fact of its existence at the present time is a tolerably sure indication that in prosperous times most of them would be needed.

The Grand Pacific, it is said, is largely owned by railroad men and has come to be head quarters for those engaged in that occupation. At the time of writing, Mr. Jay Gould, Sidney Dillon, David Dows, Chas. R. Marvin, R. P. Flower, M. L. Sykes, Jr., A. G. Dulman, C. S. Seyton, P. M. Meyers, J. L. Ten Have and others are staying at this place, the object of most of them being to attend the election of the Chicago & Northwestern and the Rock Island railroad companies, in one or the other or both of which most of them are directors. The outside public is still in ignorance of their purposes and no one knows what a day may bring forth.

Generally, the impression produced upon the visitor who knew Chicago before the fire is that it has become very much sobered. The conversation and conduct of the people has much less of that supersanguine character that it had a few years ago. "Smartness" seems to be valued less, and a clear head more. The old-fashioned virtues of prudence and economy are practiced now and better appreciated than in the days gone by, and the generation of men who grew suddenly rich by the wonderful growth of the place during the last twenty years are passing away, and it seems that their places will be taken by younger men who are more highly cultivated and whose influence and position have been earned rather than thrust upon them.

General Railroad News.

RAILROAD LAW.

Duty to Passengers at Stations.

In the case of Perry against the Central Railroad & Banking Company the Georgia Supreme Court held as follows:

When a person has purchased his ticket and arrived at the point of departure, though he has not entered the cars, he is a passenger, and while waiting for the train to set out he is, as to all duties of the company towards him directly involving his safety, entitled to extraordinary diligence, and as to all duties involving merely his convenience or accommodation, to ordinary diligence.

If the carrier has used all proper diligence in providing a suitable place for passengers to enter the cars, and has given full and fair opportunity to enter the cars at that place, a passenger who has declined to enter until the last moment is entitled only to usual and ordinary diligence in keeping him from being left. The rule of extraordinary diligence applies only to the receiving, keeping, carrying and discharging of passengers. * * *

Relatively to passengers who have needlessly lingered about the depot and neglected to board the train, the object of giving signals is to keep them from being left. The company, in giving signals to them for that purpose, is bound only to usual and ordinary diligence. And such passengers are themselves bound to exercise ordinary care and attention in looking or listening for and observing the signals. Passengers who trust to signals to avoid being left have a right to do so, but they are to be understood as trusting to such as are made in like circumstances and on like occasions in the exercise of ordinary diligence. What are such signals, and by what means they should be made, and with what degree of distinctness or loudness, are questions for the jury, under the evidence, and not for the court.

It is for the jury to say whether the danger of pursuing and boarding a train when in motion was, under the circumstances, so apparent as to make it the duty of the passenger not to undertake it, or to desist from the attempt before he was injured. Ordinarily, a railroad company has a right to expect that passengers will get on and off at the places provided for them, and there only.

A railroad company which allows the trains of another chartered company to use its depot and run over a short section of its track for approaching and leaving the depot must protect its own passengers, who are themselves not out of place, against injury from the trains of such other company. But if a passenger, by reason of his own want of promptitude in boarding the train, be out of his proper place when so injured, the company whose passenger he is is not liable for any negligence which is exclusively the negligence of the other company. Both companies being chartered, the depot and track of either, when used in common at the point of connection, may be considered the depot and track of each, relatively to its own operations and business.

Bondholders and Floating Debt Claims.

In Crumlish against the Wilmington & Western road, the United States Circuit Court for Delaware ruled out all floating debt claims and judgments, holding that the bondholders' liens could not be subordinated thereto.

In the cases of Baird and of Boughman, Thomas & Co. (who had obtained judgments on the day on which the bill for foreclosure was filed), the court decided that these judgments did not give the petitioners priority over the mortgage bondholders, and in support cited a case of the Supreme Court of Wisconsin where judgments which had been obtained prior to the foreclosure of the first-mortgage bonds were not permitted by the Court to interfere with the sale of the road (the Lacrosse & Milwaukee Railroad).

The Court therefore ordered: That the rules in all these cases be discharged, the petitions dismissed and the costs paid by the petitioners.

Foreclosures by United States Circuit Courts.

In the case of Dows and others against Miller and others, appeal from the Circuit Court, the United States Supreme Court affirmed a decree of foreclosure granted by the lower court against the Chicago & Southwestern Railroad, holding that where the road is located in part within the district whose jurisdiction is invoked, and the mortgage covers the entire property, there is authority for the decree of foreclosure, and it is said that to hold otherwise would be disastrous, not only to those owning the road, but to the holders of bonds secured by the mortgage. Multitude of bridges, say the court, span navigable streams in the United States which are boundaries of two States, and it cannot be they cannot be sold as entireties by the decree of a court. A vast number of railroads, partly in one State and partly in another, forming continuous lines, have been constructed by consolidated companies and mortgaged as entireties. More than $100,000,000 may be safely assumed to be invested in mortgages on such roads. In many cases these investments are sufficiently insecure at best, but if such roads can be sold under legal process only in fragments; if, as in this case, where the mortgage is upon the whole line, and includes the franchise of the corporation which made the mortgage, the decree can reach only the part of the road which is within the State, it is plain that the property must be comparatively worthless at the sale.

Liability for Incomplete Bonds Stolen.

In the case of Maas against the Missouri, Kansas & Texas Company the plaintiff sued to recover the value of nine stolen bonds which had been sold to him. The bonds were without the company's seal and were without the signature of the President of the Union Trust Company, which was necessary to make them valid and negotiable. The seal and signature of the President were afterwards forged, and the bonds were, for a valuable consideration, registered to Martin Maas. The plaintiffs, as holders of the bonds, sued the defendants to compel them to issue new bonds in place of the nine referred to. The case being sent by the New York Supreme Court to a referee he found for the plaintiff, but the Court set aside his finding and ordered a new trial, holding as follows:

It is well-settled law, that where the bonds of a railway company have come into the hands of a bona fide purchaser for value they may be enforced by such purchaser against the company, notwithstanding they have, in fact, been stolen from some former holder or from the company itself; but we think in no case has it been held that instruments purporting to be bonds of a railroad company, but which are in fact forgeries, and never had any legal inception as obligations of the company, can be enforced as valid bonds because the forgery has been so skillfully performed as to deceive an innocent purchaser. It seems to us unnecessary to enter upon an examination of the numerous cases bearing more or less nearly or remotely upon this question. * *

If that shall be held, there is no reason why all forged paper shall not be adjudged valid in the hands of bona fide purchasers for value against all persons whose names shall be simulated upon it; the referee should have given judgment for the defendant instead of for the plaintiff.

Aid to Narrow-Gauge Railroads in Kansas.

A law passed by the Kansas Legislature last winter provides that any company building a narrow-gauge railroad may, as soon as $500 per mile stock has been subscribed and paid in, issue first-mortgage bonds to the amount of $6,000 and second-mortgage bonds to the amount of $4,000 per mile. The second-mortgage bonds may be made to draw no interest for three years from their date, but from one year from their date a sinking fund of 2 per cent. shall be set aside yearly for their redemption.

Section 2 provides that any county, township or city in that State may issue its bonds to aid in the construction of a narrow-gauge road, to the extent of $4,000 per mile; such bonds to run not exceeding 25 years, and to draw interest at 7 per cent., and may exchange such bonds for the same amount of the second-mortgage bonds of any railroad company running into or through any county, or into or through any township or city, or within one mile of any such township or city; provided that such bonds shall not be so issued or exchanged until the same shall be authorized by three-fifths of the votes cast at some general or special election, previously held for the purpose of voting on such proposition; and provided further, that the bonds of any county, township or city authorized under this section may be issued and placed in escrow, to be delivered as fast as each section of ten miles of any such road within any such county or township shall be built and the iron put on for use, and not sooner; and at the same time the amount of the second-mortgage bonds of such railroad company shall likewise be placed in escrow, to be exchanged for said county, township or city bonds, as herein provided.

Police Powers of Conductors in Illinois.

The following law, passed at the recent session of the Illinois Legislature, is to take effect on and after July 1:

SECTION 1. That the conductors of all railroad trains carrying passengers within this State shall be invested with police powers while on duty on their respective trains.

SEC. 2. When any passenger shall be guilty of disorderly conduct, or using any obscene language to the annoyance and vexation of passengers, or playing games of cards or chance for money or other valuable thing, upon any railroad train, the conductor of such train is hereby authorized to stop his train at any place where such offense has been committed and eject such passenger from the train, using only such force as may be necessary to accomplish such removal, and may command the assistance of the employes of the railroad company, or any of the passengers, to assist in such removal; but before doing so he shall tender to such passenger such proportion of the fare he has paid as the distance he then is from the place to which he has paid his fare bears to the whole distance for which he has paid his fare.

SEC. 3. When any passenger shall be guilty of any crime or misdemeanor upon any passenger train, the conductor or employes of such train may arrest such passenger and take him before any justice of the peace in the county in which such crime or misdemeanor is committed, and file an affidavit before such justice of the peace, charging him with such crime or misdemeanor.

New York Railroad Legislation.

At its recent session the New York Legislature passed the following law:

"SECTION 1. Any person who shall willfully place any obstruction upon any railroad, or loosen, tear up or remove any part of a railroad, or displace, tamper, or in any way interfere with any switches, frogs, rail, track or other part of any railroad, so as to endanger the safety of any train, or who shall willfully throw any stone or other missile at any train on any railroad, shall upon conviction thereof be punished by imprisonment in a State prison not exceeding ten years, or by a fine not exceeding $1,000, or by both such fine and imprisonment."

Another law passed, Chapter 167, declares that "When any crime or offense shall have been committed within this State, on, in, or on board of any railroad train, indictment for the same may be found in any county through which such railroad train may pass; and such indictment may be tried in any such county in the same manner and with the like effect as in the county where the offense was committed." Chapter 224 amends the general railroad law of 1850. It provides that whenever the mortgagee or receiver of a railroad shall desire to acquire land for the use of the railroad in his care, he shall, before commencing proceedings to ascertain and appraise damages under the act, present a petition to the court under whose authority he is acting, for permission to begin such proceedings.

The Delaware Bridge Case.

In the matter of the application to restrain the Delaware & Bound Brook Company from building or maintaining a bridge over the Delaware River, the Court of Errors and Appeals of New Jersey held as follows:

1. The Attorney General has the right, where the property of the sovereign or the interests of the public are directly concerned, to institute suit for their protection, by an information at law or in equity, without a relator.

2. In a conveyance by the sovereign of property which is usually the subject of private ownership, the extent of the thing granted is to be ascertained by the rules of construction applicable to private deeds.

3. The bed of the Delaware River above tide water, from the easterly bank *ad filum medium aquæ*, passed by the grant from Charles II. to the Duke of York, and is private property.

4. The general railroad law, approved April 2, 1873, provides for conferring the franchise of bridging the Delaware, so far as the authority of New Jersey can avail for that purpose.

5. When Pennsylvania has authorized one of its railroad corporations to bridge the Delaware so as to connect with any New Jersey road, and New Jersey had authorized one of its railroad companies to bridge the Delaware so as to connect with any Pennsylvania roads, the States have exercised concurrent jurisdiction under the treaty of 1783, in such manner as to give mutual consent to the erection of a bridge by the New Jersey and Pennsylvania companies jointly, each from its own bank to the centre of the stream.

The Chancellor rightfully refused to grant the injunction, and dismissed the information. The decree below was unanimously affirmed.

Ticket Cannot be Required Unless Ticket Office is Duly Opened.

In Myrtle against the St. Louis & Southeastern Company the plaintiff was ejected from the caboose of a freight train under a rule providing that no passenger should ride on such train unless he had a ticket. He had gone to the ticket office before getting on the train but found it closed. The Circuit Court gave him damages to the amount of $562.50; the company then appealed and the Supreme Court affirmed the judgment. The latter court held that the appellant had a right to adopt a regulation that all persons who traveled on a freight train should procure a ticket before entering the cars. But such a regulation imposed upon the company the duty of having the ticket office open a sufficient length of time before the departure of the train to enable passengers to procure tickets. The conductor knew that the plaintiff had tried to procure a ticket, and after a careful consideration we have come to the conclusion that we cannot disturb the verdict on the ground that the damages are excessive.

OLD AND NEW ROADS.

Foreclosure Sales.

The *Wallkill Valley Railroad* was sold in Rondout, N. Y., June 5, under foreclosure of the first mortgage, and bought for $128,000 for account of the bondholders. It was sold under foreclosure of the second mortgage about two years ago. It is 33 miles long, from Montgomery, N. Y., to Kingston, and has

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always been a poor property, not earning its running expenses. It is operated by the Erie under contract.

The *Lake View & Collamer*, a short surburban road running out of Cleveland, O., was offered for sale in that city, May 31, under a decree of foreclosure from the Ohio Court of Common Pleas. The court had fixed $18,666 as the minimum price, but the highest offer was $17,800, and the sale was adjourned.

Dividends.

Dividends have been declared as follows:

Connecticut River, 4 per cent., semi-annual, payable July 2.

New York, New Haven & Hartford, 5 per cent., semi-annual, payable July 2.

The Ogdensburg & Lake Champlain Company will pay on July 10 the preferred stock dividend which became due April 1.

New York & Harlem, 4 per cent., semi-annual, payable July 2.

Meetings.

Meetings will be held as follows:

Cincinnati, Hamilton & Dayton, annual meeting, at the company's office in Cincinnati, June 12, at 10 a. m.

Ulster & Delaware, annual meeting, in Rondout, N. Y., June 13.

Attempt at Train Wrecking.

On the night of June 2 an attempt was made to wreck a train on the St. Louis & San Francisco road by removing a rail from the track at a lonely place in the Ozark Mountains, near Woodend Station, 155 miles from St. Louis. The speed of the train, however, had been checked by a violent storm of wind and rain, and only the engine left the track, the rest of the train remaining on. The engine upset, killing or fatally injuring three men, who were on it, but no other persons were hurt. Several shots were fired from the woods at the conductor and others, who went forward to see what the cause of the sudden stoppage was, but no further attack was made. The wreckers left a set of track tools behind them; it is believed that they intended to rob the train, but that their courage failed when they saw that none of the cars or passengers were injured. The company has since offered a reward of $5,000 for their arrest.

Illinois Central.

At the annual meeting in Chicago last week Vice-President Ackerman stated that crop prospects along the line were good. An improvement in business could hardly be expected until the new crop was ready to move, but there had been a considerable reduction in expenses.

Resolutions were passed by the stockholders expressing their appreciation of the careful management of the board, and of regret at the retirement of Mr. W. H. Osborn after many years' service as President and director.

Maxwell Land Grant & Railway.

The Amsterdam bondholders met May 19 in that city and voted to give the committee full power to foreclose the mortgages on the property, also to pay an assessment of 1 per cent. on the bonds and of ¼ per cent. on the stock.

Delaware, Lackawanna & Western.

The new time table of this road shortens the time of all trains between New York and Newark seven or eight minutes. The average gain in time from the completion of the new Bergen tunnel is really more than that, as fully two-thirds of the passenger trains were usually delayed from five to ten minutes at the Erie tunnel.

Four of the deck spans of the new bridge over the Passaic at Newark are completed, and preparations are being made to put up the remaining spans. The work is necessarily slow, as it must be so done as to leave one track always open for the passage of trains, and about 100 trains cross the bridge daily.

Pennsylvania.

The formal notice of the 10 per cent. reduction in wages was given by the following circular, signed by President Scott:

"To the officers and employes of the Pennsylvania Railroad Company:

"The following preamble and resolution were adopted by the Board of Directors at its meeting held yesterday:

"*Whereas*, The depression in all business interests of the country continues, thus affecting the usual revenues of railway companies, and rendering a further reduction of expenses necessary; therefore be it

"*Resolved*, That a reduction of 10 per cent. be made in the present compensation of all officers and employes, of every grade, in the service of the company where the amount received exceeds 10 cents per hour, to take effect on and after June 1 next.

"It is hoped and believed that all persons in the service of the company will cordially concur in this action.

"The above action of the board sets forth clearly the necessity for the reduction referred to in order to meet the exigencies of the times. But one reduction in compensation has been made by the company since the panic of 1873, and it was hoped that a revival of business would avoid the necessity of making any further abatement in the compensation of all persons in the service. As yet, however, no practical improvement has taken place in the business of the country, and while enforcing the most rigid economy in all departments of the service I am confident that all officers and employes will fully concur in the action of the board."

Similar circulars were issued on the Northern Central and on all the Pennsylvania Company roads west of Pittsburgh.

It was thought possible last week that the enginemen would resist the reduction, and it was understood that the question of a strike had been submitted to the Brotherhood. A dispatch from Philadelphia, June 5, however, states that a committee of the Brotherhood had notified President Scott that they accepted the reduced wages. It is said that some advantages as to runs, time, etc., will be granted by the company.

The only trouble was a strike among the laborers on the freight piers in New York. They are hardly a part of the working force of the road, and no difficulty was found in filling their places, many of the strikers themselves returning in a few days.

Poughkeepsie Bridge.

The first caisson for this bridge was safely anchored in place June 5, and the work of filling it begun. The second caisson will be towed into place next week and the third is nearly ready for launching.

Erie.

The Reconstruction Trustees announce that the scheme has been so modified that assessments upon the stock may be paid until June 15, with the addition of 5 per cent. interest from March 1. After June 15, 7 per cent. will be added from March 1, without additional payment.

Dallas & Wichita.

This company is negotiating for a consolidation with the Palestine & Southeastern Company, which was organized some time since. Should the negotiations succeed, it is said that work will be begun at once on an extension of the road from Dallas southeast.

Southern Pacific.

The track has been extended from Pilot Knob, where it first reached the Colorado River, down the river to a point opposite Fort Yuma. This is 249 miles from Los Angeles and 720 miles from San Francisco. Preparations are being made to build a bridge across the river.

The company has acquired control of the steamship line running between San Francisco and the mouth of the Colorado, and it is understood that all Arizona freight will hereafter be sent from San Francisco by rail. The boats now on the Colorado will continue to run.

Longview & Sabine Valley.

Track is now laid from Longview, Tex., south four miles. The road is at present used for hauling lumber to the mills at Longview and will be extended gradually as this business requires.

East & West Texas.

The track of this road has been laid for 20 miles north by east from Houston, Tex. Work is progressing steadily and the contractors expect to finish it this year to the Trinity River, 70 miles from Houston. The present end of the track is just at the edge of the great timber belt of Eastern Texas, and the rest of the road will be in that belt.

Indianapolis, Bloomington & Western.

The Master, to whom the charges made against Receiver Wright were referred, has filed his report with the United States Circuit Court. The report states that the charges were not sustained and fully exonerates Gen. Wright.

St. Louis & Southeastern.

The Auditor's report for April is as follows:

	St. Louis Div.	Kentucky Div.	Tennessee Div.	Whole line.
Earnings	$44,644 81	$20,838 37	$10,029 07	$75,512 15
Expenses	33,471 80	20,730 21	9,915 98	64,117 99
Net earn'gs.	$11,172 71	$108 36	$113 09	$11,394 16
Per ct. of exps..	75.05	99.48	98.86	84.92

As compared with April, 1876, there is a decrease of $3,574.23, or 4.7 per cent., in gross earnings, and an increase of $5,355.53, or 89.2 per cent., in net earnings.

Pittsburgh, Wheeling & Kentucky.

The Pennsylvania Company has signified its willingness to take one-half of the $200,000 bonds to be issued by this company, on certain conditions. These are that the bonds are to be sold to it at 90 and the purchase money made payable in iron rails and fastenings at $38 per ton; that one-half of the $330,000 stock of the company be transferred with the bonds, and that the remaining bonds be taken by other parties. The road has been graded for several years from Wheeling, W. Va., northward up the Ohio to a point opposite Steubenville. It has been in embarrassed circumstances since 1873, and nothing has been done until recently, when the company was reorganized. The stock is all held by Ohio and Brooke counties in West Virginia.

Mobile & Girard.

In accordance with the authority voted by the stockholders at their late meeting a new mortgage for $1,000,000 to H. H. Epping and J. E. Jones, trustees, has been executed by this company. This mortgage is to secure bonds to be issued for the purpose of repaying advances made by the Central of Georgia to pay bonds and coupons as they became due.

Lake Erie, Evansville & Southwestern.

The United States Circuit Court at Indianapolis on June 2 ordered to be entered a decree of foreclosure against this road, at the suit of T. F. Mason and A. P. Man, trustees. The Court also directed an order of sale to be entered directing the sale of the road after 90 days' notice. The amount of the bonds and accrued interest is $645,300. The road is completed from Evansville, Ind., east by north to Booneville, 18 miles, and some work has been done beyond Booneville.

New Jersey Southern.

In the matter of the claim of Berthoud & Co., contractors, who built a dock for the company at Sandy Hook, the New Jersey Court of Chancery has decided that the claimants have a lien on the property there which is on the side of the track towards the dock. They claimed a lien upon the whole property.

Wilmington & Weldon.

A fast train is now being run over this road as part of the Coast Line from Richmond to Charleston. This train makes the run of 162 miles between Weldon and Wilmington in 5½ hours, or very nearly 30 miles an hour. The time allowed heretofore has been 7⅛ hours.

St. Louis, Iron Mountain & Southern.

The application of the Union Trust Company of New York for the appointment of a receiver came up before the United States Circuit Court at Keokuk, Ia., May 30. The arguments occupied two days and at their conclusion the Court reserved its decision.

St. Louis & San Francisco.

In St. Louis, June 1, the final formal order relieving the former Receivers, Oliver Garrison and John H. Beach, and their securities, from all liability, was entered in the United States Circuit Court.

Lafayette, Muncie & Bloomington.

The late attempt of the bondholders to take possession of this road by force is not to be allowed to rest. The Grand Jury at Lafayette, Ind., has found three indictments against Mr. E. H. Waldron, Agent for the trustees, charging him with forcible entry and detainer, cutting the telegraph wires and perjury. Mr. Waldron has been arrested and has given bail to appear for trial.

Portland, Saco & Portsmouth.

At the annual meeting, June 4, the President stated that the plan recently approved by the stockholders, of issuing mortgage notes for the debt of the company, was working successfully in relieving its embarrassments, nearly all the creditors having agreed to it. The necessary supplementary agreement with the Eastern Railroad Company has been concluded. The settlement of the Boston & Maine claim for damages has been included in the recent agreement between that company and the Eastern.

Syracuse, Phœnix & Oswego.

At the recent annual meeting a special committee was appointed to confer with the directors of the Syracuse, Chenango & New York Company, to see if some assistance could not be had to complete the road from Syracuse, N. Y., to Fulton.

Wilmington & Western.

The purchasers of this road at the recent foreclosure sale met in Wilmington, Del., May 31, and organized a new company by the name of the Delaware Western Railroad Company. On the following day a meeting was held in Landenberg, Pa., and a company by the same name organized for the Pennsylvania section of the road. The two will be consolidated as soon as the necessary formalities can be gone through.

Cheshire.

This company gives notice that the bonds falling due July 1 will be paid at par and accrued interest on presentation at the Treasurer's office in Boston.

North Pacific Coast.

This road is now completed to Duncan's Mill, on the north side of Russian River, one mile beyond the late terminus at Moscow, which is upon the south side of the river. The extension to Duncan's Mill required some heavy work, including a bridge over Russian River 240 feet long, which with the approaches cost $25,000. The terminus will probably remain at Duncan's Mill for some time, although the company intends hereafter to build northward through the Walhalla Valley into Mendocino County. The road is now well into the redwood country, to reach which it was built.

Marietta & Shawnee.

A company by this name has been organized to build a railroad from Marietta, O., west by north to Shawnee in Perry County, about 45 miles. The capital stock is fixed at $450,000. Shawnee is in the centre of the Hocking Valley coal and iron region.

New Orleans Pacific.

The directors have issued an address saying that they do not mean to give up the work on account of the recent vote in New Orleans against taxing the city in aid of the road. They have now graded 55 miles of road northwest from Alexandria, and they ask for private subscriptions to enable them to carry on the work. A canvass of the city for stock subscriptions is to be made shortly.

West Wisconsin.

On June 2 the United States Circuit Court appointed Mr. W. H. Ferry Receiver. Mr. Ferry has been in charge of the road for some time, at first as Agent for the trustees and more lately as General Manager for the company. The appointment, we believe, was made on application of the trustees.

Buchanan & Clifton Forge.

This company will receive until June 21 proposals for building the whole or part of its proposed road from Buchanan, Va., to Clifton Forge, 36 miles. Plans, profiles and specifications can be seen at the office in Buchanan, and further information may be obtained of John W. Johnston, President, at Richmond, Va., or Wm. Jolliffe, Chief Engineer, at Buchanan, Va. The company will have the use of about 400 negro convicts, and contractors must employ them. Bidders will specify what price they will allow for this labor and what amount they will receive in the company's 8 per cent. first-mortgage bonds, the issue of which will be limited to $400,000.

Green Lick.

This narrow-gauge road now extends from the Mt. Vernon ore bank in Fayette County, Pa., to Scottdale on the Southwest Pennsylvania, and is three miles long. Arrangements are being made to extend it from Scottdale southward to Connellsville, about seven miles, and it is said that work will be begun soon.

Hamilton & Northwestern.

The work of locating the extension of the Lake Erie Division from Jarvis, Ont., to Port Dover has been begun and it is expected that 20 miles will be built this year.

Farmville & Southern.

It is proposed to build a narrow-gauge road from Farmville, Va., southwest through Charlotte Court House to the Staunton River and thence westward to the Virginia Midland at Pittsylvania Court House, about 65 miles, through a farming country producing chiefly tobacco and grain. The projected line is nearly parallel to the Richmond & Danville, and from 10 to 20 miles distant from that road.

Delaware.

A preliminary survey is to be made of a line from Dover, Del., on the Delaware road, south by east through Frederica and Milford to Milton and thence east to Rehoboth Beach, about 45 miles in all. The survey is made in the interest of the Delaware Railroad, of which the proposed line would be a branch, but it is stated that the line is merely experimental, and that no work will be done this year. The branch, if built, would serve the country lying between Delaware Bay and the Junction & Breakwater road, and would probably take some business from that road.

Rochester, Nunda & Pennsylvania.

The purchasers of this road at the recent sale have organized a new company known as the Rochester, Nunda & Pittsburgh Railroad Company. They are making arrangements to complete the road from the Erie at Ross' Crossing to the Dansville Branch of the same road at Sonyea.

Corpus Christi, San Diego & Rio Grande.

The grading is now completed to Precenos, Tex., 42 miles westward from Corpus Christi, and men are at work on the 12 miles from Precenos to San Diego. More iron has been ordered and is on the way.

Buffalo & Jamestown.

In the suit brought by certain tax-payers to prevent the issue of $200,000 bonds subscribed to this road by the town of Ellicott, N. Y., the Court of Appeals has finally decided the case and granted a perpetual injunction to restrain the town officers from issuing the bonds.

Nashville, Chattanooga & St. Louis.

On the extension of the Jasper Branch up the Sequatchie Valley tracklaying is in progress. The bridge over the Sequatchie River is finished and there is nothing more to delay the trackmen.

Central, of Iowa.

A dispatch from Des Moines, Ia., May 28, says: "The United States Court refused to order, upon the petition of the bondholders, the sale of the Central Railroad of Iowa, stating, however, that the trustee could exercise his own discretion in the matter, and sell if he thought the interests of all would be benefited thereby."

Atchison, Topeka & Santa Fe.

This company's report for April and the four months ending April 30 is as follows:

	April.	Four months.
Freight earnings	$131,855 23	$428,954 84
Passenger	61,727 63	202,791 [illegible]
Mail, express, etc	7,098 48	29,378 24
Total	$200,681 34	$661,025 [illegible]
Expenses	101,358 16	370,602 73
Net earnings	$99,323 18	$290,422 30
Per cent. of expenses	50.51	56.06

As compared with April, 1876, on the same mileage, there was an increase of 1.4 per cent. in gross and a decrease of 2.6 per cent. in net earnings. For the four months, with an average mileage of 711 miles this year to 670 miles in 1876, there was an increase of 3.3 per cent. in gross, and a decrease of 8.7 per cent. in net earnings.

Worcester & Shrewsbury.

At the annual meeting in Worcester, Mass., May 28, the stockholders voted to authorize the issue of bonds to the amount of $15,000, to be used in paying or funding the floating debt, which amounts to about $13,000. The road is 2.7 miles long, has a capital stock of $36,825, and no funded debt. It is of 3 ft. gauge, and is used for suburban and pleasure travel.

Nova Scotia, Nictaux & Atlantic Central.

The contractors for this road began work last week near Middleton, Nova Scotia, and have a small force employed on each side of the Annapolis River.

Welland Canal Enlargement.

The Department of Public Works of the Dominion of Canada will receive until July 5 sealed tenders for works on the enlargement of the Welland Canal, including the formation of a new line of canal from Marlatt's Pond, at Thorold, Ont., to

Allanburg, including the construction of a lift lock, guard lock, several culverts and piers and abutments for swing bridges, etc. Also, the enlargement of about two miles of the canal, from the junction downward, together with the construction of an aqueduct over the Chippawa River, a lock between the canal and the river at Welland, piers and abutments for bridges, etc. And the enlargement of the canal from Ramey's Bend to Port Colburne, including the construction of a guard lock, weir and supply race, etc. The works will be let in sections of a length suited to circumstances and the locality.

Maps of the different localities, together with plans and specifications of the works, can be seen after June 25 at the office of the Department in Ottawa, Canada, where printed forms can be obtained. A like class of information relative to the works north of Allanburg can be seen at the Resident Engineer's Office, Thorold; and for works south of Port Robinson, plans, etc., may be seen at the Resident Engineer's office, Welland.

No bids will be received unless made on the printed forms and accompanied by an accepted check or available security for from $1,000 to $5,000, according to amount of bid. This will be returned to unsuccessful bidders, but will be forfeited if the bidder declines accepting the contract if awarded. Contractors will be required to give good security and to deposit 5 per cent. of the amount of the contract with the Department in money.

Windsor & Annapolis.

This company is building an addition to its repair shops and has purchased a stationary engine and several new tools. It is also laying some steel rails and a large number of new ties, and has contracted for a new iron bridge over the Gaspereaux River near Avonport, N. S. A number of minor improvements are also being made at the stations along the line.

Fort Dodge & Fort Ridgley.

At a meeting held in Fort Dodge, Ia., recently, speeches were made in favor of this projected road, and in favor of the voting of a 5 per cent. tax in aid of its construction. The board has ordered the immediate survey of the line from Fort Dodge northward to a junction with the Sioux City & St. Paul road in Watonwan County, Minn.

Memphis & Charleston.

At the stockholders' meeting in Memphis, Tenn., May 31, resolutions were adopted authorizing the board, in case they are unable to raise the $500,000 necessary to take up the debt due the State of Tennessee, to negotiate a lease of the road to the East Tennessee, Virginia & Georgia Company.

Burlington & Lamoille.

The track of this road is now laid from Burlington, Vt., eastward to Jericho, 13 miles. The road is all graded to the junction with the Portland & Ogdensburg at Cambridge, about 17 miles northeast from Jericho. The iron is all on hand and work on the track is progressing steadily.

South Pacific Coast.

Local papers report that this company does not intend to rely upon a steamboat connection between San Francisco and its bay terminus at Dumbarton Point, Cal. Its agents have been securing the right of way for an extension from Dumbarton Point northward to Alameda.

New York & Oswego Midland.

In the United States Circuit Court in New York, June 2, argument was heard on an application to fix a lower maximum price for the road than the $2,500,000 required by the terms of the order of sale. After the close of the hearing the Court decided to postpone definite action in the matter until the decision of the United States Supreme Court is given on the appeal taken to it from so much of the decree of foreclosure as gives the receivers' certificates priority to the bondholders' claims.

Montreal, Portland & Boston.

Montreal dispatches state that Hon. Lucius Robinson, of Newport, P. Q., has bought the controlling interest of this road held by Mr. Angus, of Montreal. Work is to be pushed on the road from Chambly to West Farnham, the intersection with the Southeastern of Canada, which will complete a line to Boston by the Passumpsic and the Boston, Concord & Montreal roads. The further extension to a connection with the Portland & Ogdensburg will not be abandoned.

Mobile & Ohio.

In Memphis, May 31, the United States Circuit Court overruled the motion of Morris Ketchum and certain bondholders to be admitted as parties in the foreclosure suit. The court also denied a motion for an order to set aside the appointment of the present trustees and to restore Mr. Ketchum to the trusteeship under the first mortgage, from which he claims that he was illegally removed.

Argument on the final decree of foreclosure was begun in Mobile, June 5, before the United States Circuit Court there.

Atlantic & Great Western.

The meeting of bond and stockholders Jan. 17 voted that April 30 should be the last day for receiving deposits of bonds under the scheme, and that the reorganization trustee might exclude those who had not come in by that date, except on special terms. The trustees announce that the bonds deposited with them at the time of the meeting and at the close of the period specified were:

	Jan. 17.	May 1.	P. c. of issue.
First-mortgage bonds	$10,090,150	$12,375,305	80.4
Second " "	6,361,717	7,581,361	63.2
Third " "	12,511,437	19,432,333	67 5
Total	$28,963,304	$39,388,999	70.3

The trustees now announce that holders who wish to join the reorganization scheme will be required to pay a subscription of £3 for each first-mortgage $1,000 bond, £1 for each second mortgage and 10 shillings for each third-mortgage bond, 1 per cent. on the face of reorganization (1870) stock, and one shilling per share on the preferred and common stock. Up to June 30 these payments will be treated as contributions towards the reconstruction expenses, and receipts will be given therefor which will be exchangeable for an intended issue of $7,000,000 prior lien bonds. After June 30 no bonds or stock will be accepted except upon payment of an absolute subscription of these rates, which will not be repayable. So far the reconstruction expenses have been paid by some 200 persons only.

Connecticut River.

This company and the roads north of it are considering the question of putting on a fast express to leave Springfield on the arrival of the morning train from New York and to run by way of Brattleboro, White River Junction and Wells River, reaching Fabyan early in the evening. It is intended to accommodate the travel to the White Mountains, much of which was last year diverted from this line by the fast trains run from Boston and Norwich by way of Nashua and Concord. No final decision has been reached, but it will probably be done.

Peterboro & Hillsboro.

Work has been begun on this road and two or three miles are already graded. It is to extend the Monadnock Railroad from Peterboro, N. H., northward 18 miles to Hillsboro Bridge, where it will connect with a branch of the Concord & Claremont. It will complete a new interior line 98 miles long, from Worcester, Mass., to Concord, N. H., which is expected to command a fair traffic in business bound west and to New York from Concord and the roads above that city. The estimated cost of the road is $230,000; to meet this the company has subscriptions of $20,000 from Peterboro and $25,000 from Concord, the Northern (New Hampshire) Company advances $75,000, taking second-mortgage bonds in return, and $100,000 first-mortgage bonds are to be issued, one-half of which have already been sold to Concord parties, and it is expected that parties interested in the Boston & Albany and the Boston, Barre & Gardner will take the rest.

Central Pacific.

On the loop line from Oakland, Cal., to Bantas tracklaying has been begun on the western end and the rails are now down for 10 miles north by west from the main line at Bantas. The grading is all done to Antioch and it is thought that the track will reach that point some time this month.

Pensacola & Mobile.

The Pensacola & Mobile Railroad and Manufacturing Company is now running trains on its road from Muscogee Wharf, one mile from Pensacola, Fla., through that town to Muscogee Mills, 16 miles. The road is built chiefly to carry lumber to the company's wharf.

New Orleans, Jackson & Great Northern.

The purchasers at the late foreclosure sale have organized a new company, to be known as the New Orleans, Jackson & Northern.

Chicago & Paducah.

Immediately after Mr. Hinckley's arrest in Chicago, as noted last week, the managers of the company made application to the Illinois Circuit Court at Effingham for the appointment of a receiver, and on May 27 Mr. E. Ellery was appointed. The grounds of the application, are not stated, but it was probably made to forestall similar action on the part of the bondholders.

ANNUAL REPORTS.

Concord.

This company worked the following lines during the year ending March 31, 1877:

	Miles.
Concord Railroad, owned, Nashua, N. H., to Concord	35.0
Manchester & North Weare Railroad, owned	19.0
Concord & Portsmouth, leased, Manchester, N. H., to Portsmouth	40.5
Suncook Valley, leased, Hooksett to Pittsfield	19.5
Total	114.0

Of which 54 miles are owned and 60 leased. The company also leases the Nashua, Acton & Boston road, from Nashua, N. H., to North Acton, Mass., 20.2 miles, but its earnings are not included. The Main Line has a large traffic, being the principal link between the upper roads centering in Concord and the lower roads leading to Boston and southward.

The equipment consists of 38 locomotives; 44 passenger and 16 baggage and mail cars; 4 milk, 219 box, 532 platform, 157 coal dump and 10 freight saloon cars; 1 construction and 25 gravel cars. One engine was built during the year and 12 engines and 42 cars equipped with the Westinghouse Automatic brake.

The capital account liabilities are:

Stock ($27,778 per mile)	$1,500,000 00
Contingent account	109,632 86
Notes payable	132,936 22
Interest account	44,332 16
May dividend	75,000 00
Dividends unclaimed	2,385 00
Total ($34,524 per mile)	$1 864,286 24

The company has $127,165 invested in the Suncook Valley road; notes receivable and cash amount to $173,023.62.

The work done was as follows:

	1876-77.	1875-76.	Inc. or Dec.	P. c.
Mileage, passenger trains	228.013	225,493	Inc.. 2,520	1.1
" freight trains	254,888	251,648	Inc.. 3,240	1.3
" switching and service	187,385	150,023	Inc.. 37,362	24.9
Total	670,286	627,164	Inc.. 43,122	6.9
Passengers carried	529,355	560,860	Dec.. 31,505	5 6
Passenger mileage	12,067,832	12,987,174	Dec..919,342	7.1
Tons freight carried	612,756	625,364	Dec.. 12,608	2.0
Tonnage mileage	19,111,714	20,008,402	Dec..896,688	4.5
Av. pass. train load, No.	52.93	57.60	Dec.. 4.67	8.1
Av. freight train load, tons.	74.98	79.50	Dec.. 4.52	5.7

Of the number of passengers 235,659 last year and 254,454 the preceding year were local passengers. The earnings were as follows:

	1876-77.	1875-76.	Inc. or Dec.	P.c.
Passengers	$320,829 82	$359,047 51	Dec..$38,217 69	10.6
Freight	519,367 92	561,382 17	Dec.. 42,014 25	7.5
Express, mail and rents	31,330 34	29,928 77	Inc.. 1,401 57	4.7
Total	$871,528 08	$950,358 45	Dec..$78,830 37	8.3
Expenses	576,766 75	675,059 97	Dec.. 98,293 22	14.6
Net earnings	$294,761 33	$275,298 48	Inc..$19,462 85	7.1
Gross earn. per mile	7,644 98	8,336 48	Dec.. 691 50	8.3
Net " "	2,585 63	2,414 90	Inc.. 170 73	7.1
Per cent. of expenses.	66.18	71.03	Dec.. 4.85	6.8

The disposition of the net earnings was as follows:

Net earnings		$294,761 33
Taxes on capital stock	$33,423 29	
Manchester & Lawrence R. R., joint earnings	67,590 13	
Rent of Concord & Portsmouth R. R.	25,000 00	
" " Suncook Valley R. R.	8,094 00	
On account of Nashua, Acton & Boston rolling stock	10,000 00	
Dividends, 10 per cent.	150,000 00	
		294,107 42
Balance carried to contingent account		$653 91

The amount of fuel and material on hand at the close of the year was $197,263.20, a decrease of $8,339.62, partly caused by a lower valuation of the property. During the year 1,237 tons new iron, 501 tons new steel rails and 1,097 tons repaired iron rails and 66,256 new ties were used in repairs; 8¼ miles of track on the Concord & Portsmouth road were ballasted with gravel and 10,780 feet new sidings laid. The engine-house at Manchester was enlarged and improved, a coal shed, wood house and rail shop built there; the Portsmouth depot rebuilt; a new stationary engine was put in the Concord shop and an engine and boiler house built there. During the last four years about $479,000 has been paid for improvements of road and equipment.

* The lease of the Nashua, Acton & Boston has been of as much benefit as expected. Interest on advances made has been deducted from the rental.

Owing to diminished freight rates and the increased charges made by the lower roads a considerable decrease of earnings is expected, and lower dividends will be necessary, unless there is an increase of traffic.

Boston, Concord & Montreal.

This company owns a line from Concord, N. H., north by west to Woodville (Wells River) and thence northeast to the Grand Trunk at Groveton Junction, 145 miles in all, with a branch from Wing Road to Mount Washington, 22 miles, 167 miles in all. Seven miles of the branch, from Fabyan House to Mount Washington, were opened in July, 1876. The report covers the year ending March 31, 1877.

The equipment consists of 29 engines; 25 passenger, 2 drawing-room and 15 mail and baggage cars; 590 freight cars. Two engines, 1 passenger, 1 observation and one baggage car were added during the year; 12 engines and 33 cars were fitted with the Westinghouse brake.

The general account liabilities are as follows:

Stock, old dividends, etc	$459,600 00
" preferred	800,000 00
" new	540,400 00
Total stock ($10,778 per mile)	$1,800,000 00
Bonds ($14,593 per mile)	2,437,000 00
Coupons and dividends unclaimed	15,639 89
Profit and loss	561,446 96
Total ($28,827 per mile)	$4,814,086 85

The sinking fund holds $306,000 of the company's bonds. The company holds 680 shares of its own stock, has $7,500 invested in telegraph and steamboat stock and owns woodland costing $22,451.54.

The work done for the year was as follows:

	1876-77.	1875-76.	Inc. or Dec.	P. c.
Mileage, passenger trains	372,609	332,367	Inc..40,242	12.1
" freight trains	310,125	267,244	Inc..42,881	13.8
" service trains	20,751	61,596	Dec..40,845	66.3
Total	703,485	661,207	Inc..42,278	6.4
Passengers carried	211,689	228,634	Dec..16,945	7 4
Passenger mileage	7,499,539	7,232,991	Inc. 266,548	3.7
Tons freight carried	126,434	117,831	Inc.. 8,603	7.3
Tonnage mileage	7,586,019	7,069,858	Inc .516,161	7.3
Av. pass. train load, No.	20.13	21.76	Dec.. 1.63	7.5
Av. freight train load, tons.	24.46	26.45	Dec.. 1.99	7.5

The local business furnished 137,802 passengers and 19,902 tons of freight. The earnings for the year were as follows:

	1876-77.	1875-76.	Inc. or Dec.	P. c.
Passengers	$250,295 36	$276,162 09	Dec.$25,866 73	9.4
Freight	370,849 70	386,607 83	Dec..15,758 13	4 1
Mails, express, etc.	28,162 75	30,585 05	Dec.. 2,422 30	7.9
Total	$649,307 81	$693,354 97	Dec.$44,047 16	6.4
Expenses	457,377 44	511,342 64	Dec..53,965 20	10.6
Net earnings	$191,930 37	$182,012 33	Inc..$9,918 04	5 4
Gross earn. per mile	3,935 20	4,333 47	Dec.. 398 27	9.2
Net " " "	1,163 21	1,137 58	Inc.. 25 63	2.3
Per cent. of expenses	70.44	73.75	Dec.. 3.31	4.5

The year was unusually unfavorable for summer travel, which forms a large part of the business of the road, and, like all roads similarly situated, the Centennial and its attractions drew away much traffic.

The income account for the year was:

Bonds and cash on hand		$139,573 80
Net earnings		191,930 37
Interest received		9,225 52
Fuel, stores and material on hand less than last year		23,050 18
Sale of consolidated bonds		43,000 00
Total		$406,779 87
Coupons and interest	$145,662 55	
Preferred stock dividends	44,656 00	
In hands of Superintendent more than last year	18,819 43	
Sundry expenses	5,124 19	
Branch to Mt. Washington	43,000 00	
		257,261 17
Bonds and cash on hand, March 31		$149,518 70

Deducting decrease in stores and adding increase of amount in Superintendent's hands, there was a net gain of $5,417.15 for the year.

During the year 804 tons of 56-lb. rails and 89,612 new ties were laid, the light rails taken up being for the most part used on the branch. New bridges were built at Tilton and Sewall's Falls and others repaired.

The lease, held jointly with the Connecticut & Passumpsic Rivers Company, of the Southeastern Railway of Canada has expired, but has been practically continued. The benefits derived from the lease have exceeded the losses.

The extension of the branch to Mount Washington has proved all that was expected. In addition to passenger travel it has carried a considerable traffic in lumber, especially poplar for the paper mills of New Hampshire and Massachusetts. It is hoped that the extension of the Main Line to Colebrook can soon be begun.

The Portland & Ogdensburg trains continue to use the track from Fabyan to Scott's Mills, but the business of that road is very light and the compensation small. An arrangement has been made up to April 1, but no money has been paid.

The expenses include $20,437 for damages resulting from accidents several years ago. All claims of this class have now been finally settled. No serious accident occurred last year and the only casualty was the killing of two women who tried to cross the track in front of a train.

South Carolina.

This company owns and works the following lines:

	Miles.
Charleston, S. C., to Augusta, Ga.	137
Branchville, S. C., to Columbia	68
Kingsville, S. C., to Camden	37
Total	242

It is the chief through railroad connection of Charleston and the principal carrier for that section of the State west and southwest of the city, and through its connections it controls most of the business of the hill country of South Carolina. The report is for the year ending Dec. 31, 1876.

The equipment consists of 44 engines; 23 first and 26 second-class passenger cars; 357 box, 13 stock and 104 platform cars. Five of the engines, however, are old ten-wheelers which have been condemned and will be broken up. The freight equipment is insufficient, more cars being needed. During the past year the Westinghouse automatic brake has been fitted to all the passenger cars.

Besides the road and equipment the company has $468,085.33 invested in Greenville & Columbia securities, $250,802.25 in Macon & Augusta stock, and $427,805.83 in other railroad and steamship stocks, making $1,146,693.41 so invested. During the year 1,230 shares in the New York & South Carolina Steamship Company were sold; the cost of 154 shares Wilmington & Manchester and 400 shares Blue Ridge stock was charged to profit and loss. The balance of $574,628.46 at debit of Southwestern Railroad Bank account was also charged to profit and loss.

The credit side of the general account is as follows:

Stock ($24,047 per mile)	$5,819,275 00
Bonds ($20,337 per mile)	4,921,478 80
Bills payable, fare tickets, loans, etc	1,074,399 32
Coupon account	160,661 12
Transient creditors	79,544 10
Total ($49,816 per mile)	$12,055,358 34

The debt account after deducting all assets but road and equipment shows a balance of indebtedness of $3,773,700.44, or $15,594 per mile. During the year there was a net increase of

$331,388.89 in the bonded debt, and a net decrease of $380,380.91 in the floating debt. Since the close of the year the floating debt has for the most part been extended and the rate of interest reduced to 7 per cent.

The work done as reported was as follows:

	1876.	1875.	Decrease.	P. c.
Locomotive mileage, revenue	708,212	738,836	30,624	4.15
" " switching and service	116,335	149,956	33,621	22.41
Total	824,547	888,792	64,245	7.23
Passengers carried	119,326	158,735	39,409	24.83
Tons freight carried	252,630	261,680	9,050	3.46

The receipts of leading articles at Charleston and the shipments of fertilizers from that place for three years were:

	1876.	1875.	1874.
Bales cotton	336,814	296,245	343,786
Barrels flour	71,330	58,345	72,659
Bushels grain	371,166	171,776	218,427
Bales domestics	15,456	24,375	25,294
Barrels naval stores	52,185	43,872	48,956
Head live stock	9,696	12,133	12,597
Tons fertilizers	31,695	36,157	31,283

The freight earnings for the last three years were derived from the following sources:

	—Percentage of total.— 1876.	1875.	1874.
On business to and from Charleston, local	75.5	70.8	61.9
On business to and from Charleston, through	18.7	23.9	33.6
On business outside of Charleston	5.8	5.3	4.5

The decrease of the Charleston through business is notable, and is ascribed chiefly to the sharp competition of the other through lines, decreasing not only the amount of business but, in much greater proportion, the rates thereon.

The earnings for the year were as follows:

	1876	1875.	Inc. or Dec.	P. c.
Passage	$200,754 57	$229,221 30	Dec.. $28,466 73	12.42
Freight	907,506 37	981,905 44	Dec.. 74,399 07	7.58
Mails	18,176 10	18,176 10	....	....
Total	$1,126,439 04	$1,229,302 84	Dec.. $102,865 80	8.37
Expenses	647,752 64	780,727 89	Dec.. 132,975 25	17.03
Net earnings	$478,684 40	$448,575 95	Inc .. $30,109 45	6.71
Gross earn. per mile	4,655 61	5,079 76	Dec.. 424 15	8.37
Net earn. per mile	1,978 03	1,853 62	Inc .. 124 41	6.71
Per cent. of exp's	57.51	63.51	Dec.. 6.00	9.45

The income account was as follows:

Net earnings		$478,684 40
Incidental income		4,254 13
Total		$482,938 53
Interest and premium, sterling bonds	$90,932 09	
Interest, domestic bonds	148,697 50	
Interest, non-mortgage bonds, bills payable, etc.	193,468 68	
		433,098 27
Surplus to profit and loss		$49,840 26

There were used in renewals 100 tons steel rails, 1,353 tons iron rails and 99,385 ties. The road-bed has been kept in good condition. All the trestles on the road have now been rebuilt with cypress timber except that over the Wateree Swamp, which is being gradually renewed with cypress as repairs are required. The saving in expenses is due to very strict economy and to reductions both in number and wages of the working force of the road.

The President's report notes that no revenue was derived from the securities held by the company. It refers also to the loss of through business by increased competition and the relative increase of local business, though that was restricted by short crops and general depression. The policy of the board has been to protect the local interests and to seek through traffic only when it could be done without interfering with local business.

Georgia.

This company owns a line from Augusta, Ga., to Atlanta, 171 miles; a branch from Barnett, Ga., to Washington, 18 miles; a branch from Union Point to Athens, 39 miles, and a branch from Camak to Warrenton, 3 miles, 231 miles in all. It controls and works the Macon & Augusta road, from Warrenton to Macon, 75 miles. Its report covers the year ending March 31, 1877.

The equipment consists of 49 engines, of which one has been condemned; 28 passenger, 2 sleeping, 9 baggage, 3 mail and 3 express cars; 525 box, 34 stock, 61 coal, 114 platform and 26 caboose cars; 1 pay, 2 wood and 23 shanty cars.

The property is represented as follows:

Stock ($18,182 per mile)	$4,200,000 00
Bonds ($2,294 per mile)	530,000 00
Bank notes and change bills	77,673 43
Profit and loss, balance	606,131 75
Total ($23,436 per mile)	$5,413,805 18

The company owns stocks inventoried at $595,000, the largest item being $400,000 Atlanta & West Point stock; bonds valued at $117,360, and has $361,005.81 invested in the Western Railroad of Alabama, which it owns jointly with the Central of Georgia.

The work done, so far as stated, was:

	1876-77.	1875-76.	Increase.	P. c.
Engine mileage	1,162,300	1,083,446	78,854	7.3
Bales cotton carried	272,602	206,255	66,347	32.2
Bushels grain	1,667,529	1,366,887	300,632	22.0
Barrels flour	149,460	126,548	22,912	18.1
Tons fertilizers	37,708	28,547	9,161	32.1

There was a large increase of cotton, much of it due to the diversion of business from Savannah during the yellow fever epidemic. The increase in grain and fertilizers was mainly on local account. The earnings for the year were:

	1876-77.	1875-76	Inc. or Dec.	P. c.
Passage	$194,280 76	$245,119 53	Dec.. $50,838 77	20.7
Freight	919,641 88	920,911 60	Dec.. 1,269 72	0.1
Mails	29,205 60	28,292 94	Inc.. 912 66	3.2
Total	$1,143,128 24	$1,194,324 07	Dec.. $51,195 83	4.3
Expenses	643,110 30	641,677 93	Inc.. 1,432 37	0.2
Net earnings	$500,017 94	$552 646 14	Dec.. $52,628 20	9.5
Gross earn. per mile.	4,948 61	5,170 23	Dec.. 221 62	4.3
Net earn. per mile...	2,164 58	2,392 41	Dec.. 227 83	9.5
Per cent. of exp'nses.	56.26	53.73	Inc.. 2.53	4.7

The receipts on securities owned by the company were $58,086.27. Besides $37,520 on its own bonds the company paid as guarantor $249,405.54 on Macon & Augusta bonds and $137,472.20 on Port Royal bonds; it also paid $83,670 on coupons assumed with the Western Railroad of Alabama.

The Roadmaster reports that there were used in renewals 856¼ tons new iron rails, 506 tons steel rails, 470,990 feet lumber and 103,708 ties. Two iron spans and one wooden span have been erected at the Oconee River, in place of the bridge burned a year ago. The use of steel for renewals and the ballasting of the track are recommended. The Master Mechanic reports five engines burning coal with such success that most of the others will be altered to burn coal also, as soon as opportunity offers; he recommends the purchase of 2 passenger and one shifting engines, to replace old light engines to be condemned.

The Superintendent says that the road has suffered from general depression of business and by the opening of the Northeastern Railroad from Athens, which has diverted much business. Arrangements have been made to run a fast train from New York to New Orleans, using this road between Augusta and Macon. The expenses were not diminished, owing to the loss of the Oconee Bridge by fire and serious damage about Macon by freshets.

President King states that 13 miles of steel rails have been ordered for use in the current year. He approves of the policy of putting the road in good condition, but has not much hope of present improvement in business.

MACON & AUGUSTA.

The earnings of this line for the year were:

	1876-77.	1875-76.	Inc. or Dec.	P. c.
Freight	$90,685 50	$74,479 29	Inc.. $16,206 21	21.8
Passengers	21,693 91	29,661 35	Dec.. 7,967 44	26.8
Mail	3,950 04	3,950 04	....	....
Total	$116,329 45	$108,090 68	Inc.. $8,238 77	7.6
Expenses	98,040 15	94,254 35	Inc.. 3,785 80	4.0
Net earnings	$18,289 30	$13,836 33	Inc.. $4,452 97	32.2
Gross earnings per mile	1,551 06	1,441 21	Inc.. 109 85	7.6
Net earn. per mile.	243 86	184 48	Inc.. 59 38	32 2
Per cent. of exp'n's.	84.28	87.20	Dec.. 2.92	3.3

The business of the road continues light, though there was an increase last year, partly due to diversion of Savannah business. The expenses were increased by serious damage to the line from wash-outs near Macon.

St. Paul & Pacific.

Our Amsterdam correspondent sends us the following summary of the report of the trustees, which has not yet been published:

On Oct. 7, 1876, the trustees, Horace Thompson, Edmund Rice and John S. Kennedy, took possession of the whole property on behalf of the bondholders and in accordance with Article 9 of the mortgage deed, and appointed Mr. J. P. Farley General Manager. The same day the lease of the line from St. Cloud to Melrose was revoked and the line has since been worked by Mr. Farley.

During 1876 the bonded debt was decreased by the sale of land as follows: Of the Main Line, $756,500 bonds and $159,303.75 coupons of the $3,000,000 loan, $516,000 bonds and $113,335.80 coupons of the $6,000,000 loan; of the Branch Line, $30,500 bonds and $10,527 coupons of the $1,200,000 loan, $23,000 bonds and $4,584 coupons of the $2,800,000 loan.

The statement for the Main Line, St. Anthony to Breckenridge, 207 miles, is as follows:

Gross earnings ($2,892 per mile)	$598,731 91
Working expenses (62.01 per cent.)	371,248 09
Net earnings ($1,099 per mile)	$227.483 82
Legal expenses, loss, etc	22,395 49
Balance	$205,088 33

On the Branch Line from St. Paul to Sauk Rapids, 76 miles, the statement is:

Gross earnings ($4,555 per mile)	$346,179 31
Expenses (60.52 per cent.)	209,505 63
Net earnings ($1,798 per mile)	$136,673 68

On Jan. 1, 1877, there was $124,421.45 to credit of the Main Line and $169,912.89 to the Branch Line, after paying all debts but $19,866.05 for right of way. The tariff was nearly unchanged, but the revenue increased and the expenses diminished. The grain traffic was injured by the grasshoppers. There were laid 500 tons of steel rails, and 600 tons of iron rails are to be used in 1877.

The Land Department reports land sales up to Jan. 1, 1877, as follows: For the Main Line amount of sales $2,780,646.22; cost of administration, $194,869.16. For the Branch Line amount of sales $394,724.02; cost of administration, $103,868.41.

On the St. Vincent Extension there are completed 35 miles, from St. Cloud to Melrose, and 104 miles, from 12 miles south of Glyndon to 28 miles north of Crookston; part of the grading and bridges from Melrose to Alexandria are done. On the Brainerd Branch 4½ miles south from Brainerd are completed, and 50 miles more, to Watab, are graded.

On the line from St. Cloud to Melrose the earnings from Oct. 7 to Dec. 31 were:

Gross earnings ($342 per mile)	$11,954 27
Expenses (51.73 per cent.)	6,207 14
Net earnings ($165 per mile)	$5,747 23
Rental at $500 p. r month, Jan. 1 to April 1, 1876	1,500 00
Rental at $1,250 per month, April 1 to Oct. 7, 1876	7,812 50
Total net receipts for 1876	$15,059 73

On the line north of Glyndon a connection of 11 miles from Crookston to Fisher's Landing was built by the Receiver in cooperation with the Red River Transportation Company. The earnings were:

Gross earnings	$44,409 57
Expenses (56.16 per cent.)	24,935 85
Net earnings	$19,473 72

Under present arrangements the freights for Manitoba are carried over the Northern Pacific to Glyndon, and it is in the interest of the Northern Pacific to prevent as long as possible the completion of the line from Melrose to Glyndon, which would deprive it of this Manitoba business and also of the traffic of the Red River wheat country in Minnesota. The St. Paul & Pacific committee proposes therefore to build a connection from the Main Line at Breckenridge to Barnes (12 miles south of Glyndon), a distance of 32 miles, which would complete a line of 339 miles from St. Paul to Fisher's Landing. The cost of this connection is estimated at $287,698, to meet which the committee proposes to issue $300,000 preferred stock, to bear 10 per cent. interest, to meet which a special tariff will be charged over the line. Our correspondent objects to this that it would be a great injury to the St. Vincent Extension bondholders, delaying the completion of their line and depriving it of traffic.

LOCOMOTIVE RETURNS, FEBRUARY, 1877.

Master Mechanics of all American railroads are invited to send us their monthly reports for this table.

Name of Road.	Number of miles operated	Number of Locomotives in service	Mileage. Total	Mileage. Average per Engine	No. Miles run to Ton of Coal	No. Miles run to Cord of Wood	No. Miles run to Pint of Oil	Average No. of freight cars hauled	Average cost per freight car per mile, cents.	Cost per Mile in Cents for Repairs	Cost per Mile in Cents for Fuel	Cost per Mile in Cents for Stores	Cost per Mile in Cents for Miscellaneous	Cost per Mile in Cents for Engineers, firemen, and wipers	Cost per Mile in Cents for Total	Av. c'st of Coal, per ton or bush.	Av. c'st of wood per cord ... bush.
																$	$
Allegheny Valley*	259	....	97,370	.....	33.23	.....	20.29	19.50	0.878	6.98	4.01	0.68	.....	7.00	18.67	.....	.....
Atlantic & Great West'n (1st & 2d Divs.)†	228	83	174,384	2,101	38.82	.....	18.07	.....	.....	4.62	5.16	0.57	0.89	6.29	17.53	1.84	3.11
" " (Third & Fourth Divs.)†	197	48	114,116	2,377	38.82	.....	20.00	.....	.....	4.46	5.16	0.44	0.83	5.87	16.76	1.84	3.11
" " (Mahoning Division).†	88	54	81,155	1,503	38.82	.....	23.88	.....	.....	4.43	5.16	0.40	0.75	6.07	16 81	1.84	3.11
Atlantic & Gulf	343	91	60,837	2,897	.....	55.64	18.36	.....	.....	2.01	4.60	0.48	.....	7.74	14.85	.....	2.47
Cairo & Vincennes	157	11	27,018	2,456	37.20	.....	14.60	.....	.....	4.91	4.19	0.42	.....	5.74	15.26	1.50	.....
California Pacific	148	11	31,084	2,826	57.88	49.66	19.94	.....	.....	14.42	13.41	0.61	0.38	7.46	36 28	8.00	5.00
Camden & Atlantic	67	12	15,538	1,295	64.30	.....	16.65	.....	.....	6.40	6 77	0.68	.....	5.71	19.56	4.16	2.00
Central Pacific (Western Division)‡	202	52	110,580	2,127	47.06	.....	18.46	.....	.....	11.47	15.45	0.59	0 56	8.92	36.99	7.25	5.00
" " (Visalia Division)‡	157	14	32,781	2,342	62.02	.....	20.83	.....	.....	6.12	11.72	0.51	0.14	6.77	25.26	7.25	5.00
" " (Tulare Division)‡	171	12	26,809	2,234	38.22	.....	14.09	.....	.....	3.94	19.01	0.74	0 21	8.20	32.10	7.25	5.00
" " (Los Angeles, Yuma, San Diego and Wilm. Divs.)‡	273	16	46,148	2,884	51.25	.....	13.67	.....	.....	3.56	14.18	0.81	0.03	7.23	25.81	7.25	5.00
" " (Sacramento Division)‡	120	41	78,874	1,924	75.00	29.26	16.39	.....	.....	9.23	16 98	0.63	0.45	8.78	36.07	7.25	5.00
" " (Oregon Division)‡	151	7	19,100	2,729	.....	41.43	22.93	.....	.....	4.68	12.06	0.47	0.29	8 59	26.09	.....	5.00
" " (Truckee Division)‡	205	27	56,834	2,105	36.59	27.88	19 05	.....	.....	11.65	19.00	0.58	0.52	8.66	40.41	7.25	5.00
" " (Humboldt Division)‡	201	17	41,814	2,460	46.19	.....	18.00	.....	.....	9.66	15.73	0 56	0.43	7.59	33.97	7.25	5.00
" " (Salt Lake Division)‡	219	26	68 404	2,631	37.55	.....	15.25	.....	.....	4 46	19.34	0.74	0.49	7.07	32.10	7.25	5.00
Cleve., Col., Cin. & Ind. (Col'bus Div.)..	138	59	152,973	2,593	44.21	126.00	30 06	.....	.....	2.34	4.44	0.58	0.82	5 73	13.91	1.75	3.50
" " " (Indianapolis Div.)..	207	66	189,845	2,877	42.78	47.36	23.64	.....	.....	3.96	4.77	0.61	1.42	5.54	16.30	1.75	3.50
" " " (Cincinnati Div.)...	130	35	74,378	2,125	37.19	.....	22.77	.....	.....	7.21	5.12	0.60	0.92	5.94	19.79	1.75	3.50
Cleveland & Mahoning Valley	41	6	14,293	2,382	34.86	.....	23.58	.....	.....	0.84	5.39	0.30	1.18	6.54	14.25	1.68	2.82
Cleveland & Pittsburgh*	199	77	130 817	1,699	41.94	.....	20.53	15.20	1.081	3 59	3.46	0.59	2.62	7.72	17.98	1.21	3.80
Del., Lacka. & West. (Bloomsburg Div.)§	80	23	46,120	2,096	.....	.....	33 42	.....	.....	4.81	....	0.71	.....	5.98	11 50	.....	.....
Erie & Pittsburgh*	98	29	41,023	1,415	37.19	.....	13 43	15.10	1.086	2.41	5.00	0 88	2.17	7.33	17.79	1.65	3.96
Hannibal & St. Joseph	296	....	167,212	.....	37 20	.....	20.90	.....	.....	6.21	5.62	0.39	.....	6.94	19.16	2.00	5.00
Illinois Central (Chicago Div)‖	253	50	116,778	2,336	36.58	.....	15.00	20.14	.....	4.01	5 52	0.32	.....	6.16	16.02	1.90	4.50
" " (South Div.)‖	231	39	75,307	1,931	36 69	.....	13.11	15 44	.....	5.44	5.46	0.35	.....	5.86	17.11	1.90	4.50
" " (North Div)‖	225	49	73,990	1,510	2~.65	.....	11.14	15 42	.....	7.54	6.91	0.41	.....	6.35	21.21	1.90	4.50
" " (Iowa Div.)‖	401	53	87,600	1,653	29.94	.....	14.84	11.70	.....	6.31	9 43	0.38	.....	6.11	22.18	2.75	4.70
Jeffersonville, Madison & Indianapolis*	226	41	77 912	1,900	42.60	26 99	12 80	18.27	1.070	3 77	6.40	0.57	3.40	6.52	20.66	2 60	2 20
Kansas Pacific and controlled lines¶	914	77	162 892	2,115	25.05	.....	10.65	.....	.....	4 81	12.52	0.54	.....	7.20	25 07	3.08	4.09
Kansas City, St. Jo. & Council Bluffs**	275	28	61,592	2,200	50.20	.....	25.40	16.10	.....	4.50	6.30	0.50	.....	6 00	18 20	3.00	3.50
Lake Shore & Mich. So. (Buff. Div.)††	.....	90	178 463	1,982	36.90	45.17	.....	.....	.....	3.96	8.57	0 54	.....	6.25	19 35	3 05	5 69
" " (Erie Div.)††	.....	113	204.245	1,807	36.42	60.36	.....	.....	.....	5 52	7.88	0.42	.....	5.99	19.81	2.72	5.43
" " (Toledo Div.)††	.....	85	137,974	1,623	32.85	50.64	.....	.....	.....	3.87	9.52	0.52	.....	6 22	20.13	3.12	4 68
" " (Mich. So. Div.)††	.....	207	366,597	1.771	34.40	52.73	.....	.....	.....	4.86	10.01	0.36	.....	6.55	21.56	3.55	4.63
Little Rock, Mississippi River & Texas.	100	4	8,148	2,037	.....	69.60	25.00	.....	.....	3.18	2 15	0.28	1.35	9.01	15 99	.....	1 50
Marquette, Houghton & Ontonagon	88	9	11,111	1,235	57.86	.....	21.80	.....	.....	2.07	8.97	0.48	.....	6.33	17 85	.....	.....
Missouri, Kansas & Texas	786	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
North'n Cent'l (Elm. & Canand'gua Div.)	147	47	105,020	2,234	24.97	....	17.86	.....	.....	4.58	7.3	0.71	.....	6.34	18.95	0.07	2.68
Pennsylvania (New York Division)‡‡	120	128	263,227	2,056	29.97	.....	9.94	.....	.....	7 00	12.20	1.20	.....	.....	20 40	0.144	5.78
" (Amboy Division)‡‡	154	45	80,716	1,794	50.19	.....	15 67	.....	.....	5 40	7 30	0 80	.....	.....	13.50	0.144	5.31
" (Belvidere Division)‡‡	103	37	60,020	1 622	31.23	.....	10.87	.....	.....	7.00	11.70	1 10	.....	.....	19 80	0.144	5.28
" (Philadelphia Division)‡‡	191	182	376,417	2,068	26.61	.....	12.76	.....	.....	3.20	4.80	0 90	.....	.....	8.90	0.048	2.88
" (Middle Division)‡‡	132	108	238 495	2.764	25.27	.....	16.56	.....	.....	4.80	4.80	0.80	.....	.....	10.40	0.048	2.88
" (Pittsb'gh Div., E. End)‡‡	.....	80	146,711	1,834	20.40	.....	9.40	.....	.....	9.50	6 0	1 10	.....	.....	16.60	0.048	2.88
" (Pittsb'hDiv., West End)‡‡	.....	117	241,704	2.066	30.57	.....	12.56	.....	.....	10.10	4 00	0 90	.....	.....	15.00	0.048	2 89
" (Tyrone Division)‡‡	107	30	64,103	2,137	22.53	.....	17 48	.....	.....	2.60	5 60	0.7-	.....	.....	8 90	0.048	2.99
" (West Pennsylvania Div)‡‡	104	26	37.552	1,444	36.52	.....	25.91	.....	.....	3.40	3.60	0.50	.....	.....	7 50	0.048	2 92
" (Lewistown Division)‡‡	56	7	10,665	1,524	33.77	.....	15.43	.....	.....	2.30	3.70	0.70	.....	.....	6 70	0.048	2 92
" (Bedford Division)‡‡	57	5	9,271	1,854	27.72	.....	18.12	.....	.....	23.20	4.40	0.60	.....	.....	28.20	0.048	2.95
Pitts., Ft. Wayne & Chi. (East'n Div.).*	371	150	325,442	2,170	44.26	.....	14.61	13 60	1.226	4.59	3.6	0.81	1.66	6 80	17.47	1.60	1.59
" " " (Western Div.)*	280	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pitts., Cin. & St. L. (Little Miami Div.)*	197	40	83,173	2.079	40.31	.....	11.40	15.18	1 113	4.97	6 79	0 86	3.08	6.40	22 10	2.63	3.50
" " " (Pitts.Cin. & St.L. Div.)*	224	77	211,537	2,747	28.58	.....	16 39	16.53	1.040	6.39	4.16	0.76	2.10	6.44	19.85	1.10	3.00
Pittsburgh, Titusville & Buffalo*	158	....	47,655	.....	37.68	.....	17.77	14.98	1.355	4.39	5.06	0.64	.....	6.69	16.78	.....	2.99
St. Louis, I. M. & So. (Arkansas Div.)...	325	32	75,375	2,355	.....	47.50	18.70	.....	.....	3.15	5.92	0.59	.....	7.08	16.74	.....	5.00
Stockton & Copperopolis	49	3	3,455	1,152	67.18	83.52	17.90	.....	.....	1.26	6.75	0.65	0 88	10.25	19.79	3.19	5.85
West Jersey ‡‡	128	13	28 404	1,892	43.37	37.88	17.57	.....	.....	9.00	8.30	0 60	.....	.....	17.90	0.128	
Three months ending Feb. 28:																	
Terre Haute & Indianapolis (Indianapolis Division	80	....	259,761	.....	26.80	.....	22 0-	.....	.....	5.31	5.82	0.79	1.86	6.83	20 61	.....	.....
Terre Haute & Indianapolis (Vandalia Division)	158	....	256,296	.....	27.40	.....	23 80	.....	.....	5.95	6 07	0.87	1 89	6 30	21.08	.....	.....

* Five empty cars rated as three loaded ones.
† Fuel averages are for the whole road.
‡ Switching engines allowed 6 miles per hour; helping engines actual distance and 4 miles per hour while waiting trains.
§ Fuel not estimated
‖ Two empty cars rated as one loaded one.
¶ Switching and work train engines allowed 6 miles per hour.
** Three empty cars rated as two loaded ones.
†† Switching engines allowed 6 miles per hour.
‡‡ Engineers', firemen's and wipers' wages not included in cost.
The ton of coal is 2,000 lbs., unless otherwise specified; 25 bushels counted to the ton.

MANUFACTURERS OF ROLLING STOCK FOR RAILROADS, FROGS, CAR WHEELS,

Capital Stock, $750,000.
Grounds Occupied, 18 Acres.
Capacity, 15 Freight Cars & 160 Car Wheels per day.

And all Kinds of Castings.

10 Passenger and Baggage per Month.
EMPLOY 1,000 MEN.
Six Million Feet Lumber in Store.

SPECIAL ATTENTION GIVEN TO NARROW GAUGE WORK.

PHOTOGRAPHS OF WORK SENT ON APPLICATION.

E. E. BARNEY, Pres't.
PRESERVED SMITH, Vice-Pres't and Treas.

ESTABLISHED 1849.

BARNEY & SMITH M'F'G CO.,

DAYTON, OHIO.

E. J. BARNEY, Supt.
J. D. PLATT, Sec'y,
F. E. SMITH, Ass't Sec'y.

EMPLOYMENT.

Advertisements of situations wanted or of officers or employes wanted will be inserted under this heading for TWO CENTS PER WORD *for the first publication and* ONE CENT PER WORD *for each subsequent insertion. Payment must be made in advance. Letters forwarded.*]

WANTED—SITUATION AS FOREman Blacksmith in a first-class Railroad Shop by a man of experience. Good references given. Address "FOREMAN," *Railroad Gazette* office, 73 Broadway, New York.

WANTED—A POSITION IN AN ENgineer's or railroad office, or on any field or railroad surveys. One year's experience on latter and nearly two years on topographical and water-works surveys. Best references given and to work done. Pay not so much an object as chance for trial. Address Box 373, New Haven, Conn.

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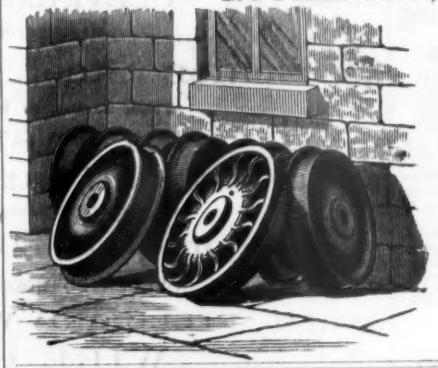

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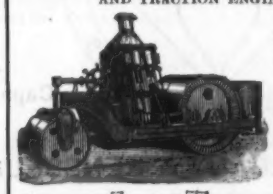

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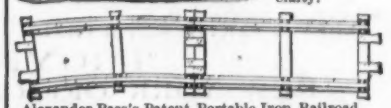

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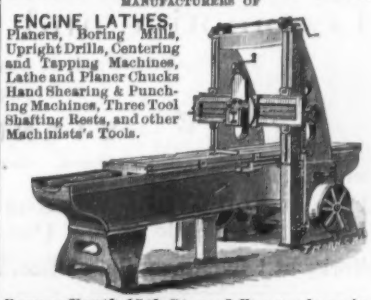

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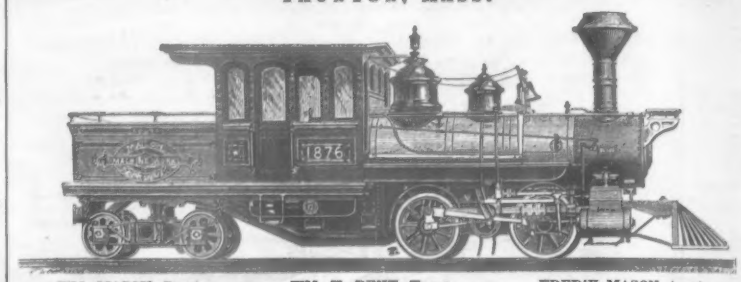

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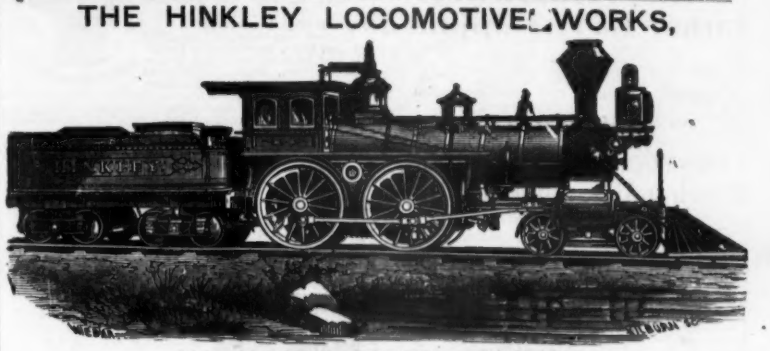

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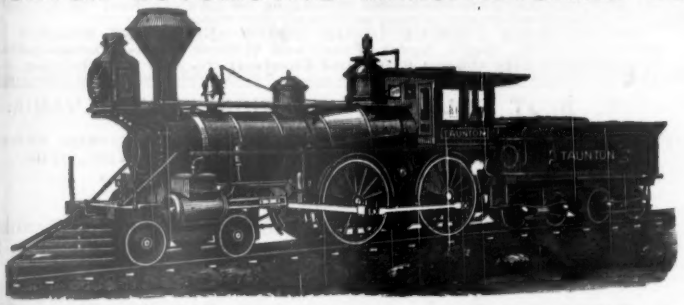

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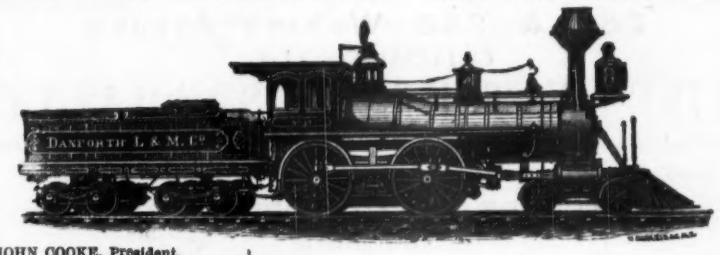

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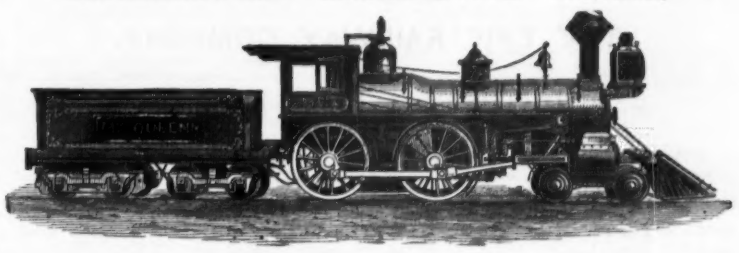

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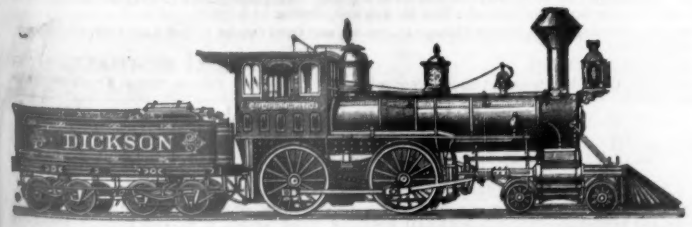

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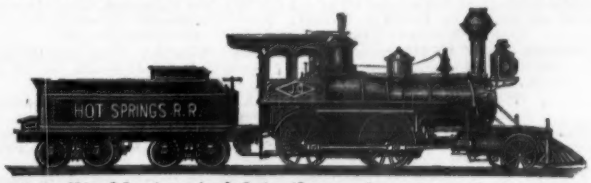

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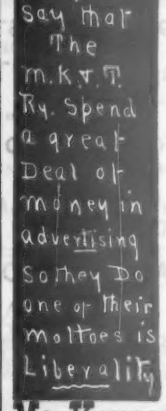

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For **Dubuque** via **Freeport**—Two through trains daily, with Pullman Cars on night train.

For **Dubuque** and **La Crosse** via, Clinton—Two through trains daily, with Pullman cars on night train to McGregor, Iowa.

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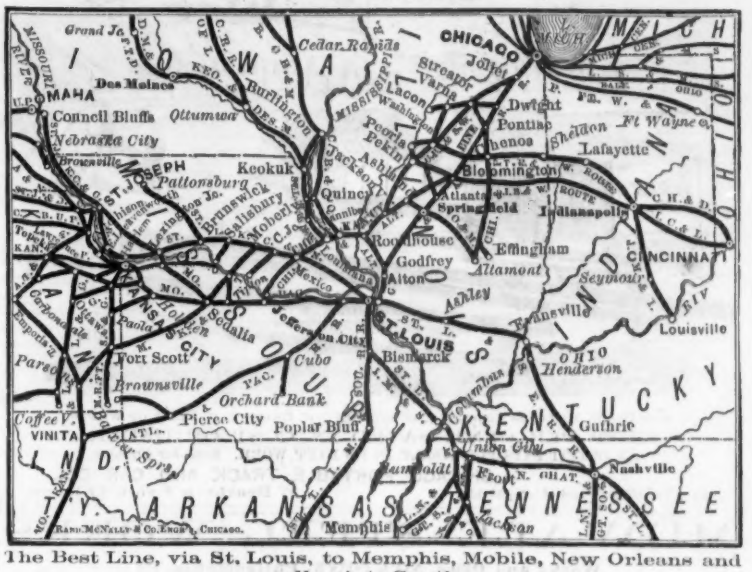

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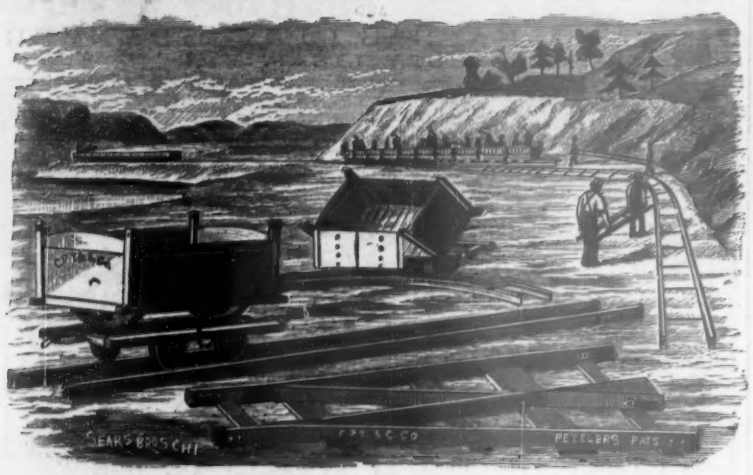

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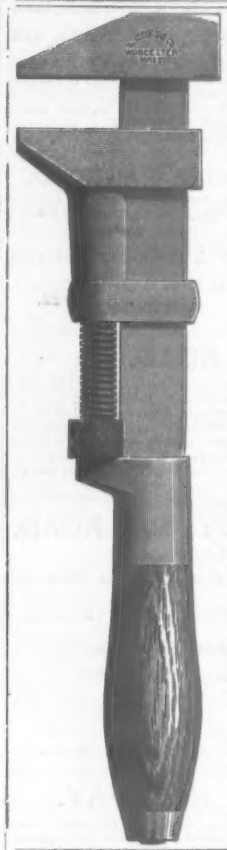

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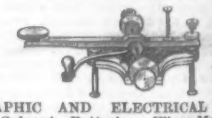

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